



Climate Resilient SD



Letter from the Mayor:



Over the past two years of the COVID-19 pandemic, San Diego's communities have shown what it means to be resilient. Our residents and businesses have shown up for each other during these difficult times, we've adapted to changing conditions and environments, and figured out new ways of doing things. Now, as the impacts of climate change like wildfires and extreme heat intensify, we have an opportunity to harness this same resilience to create a safer, healthier, and more prosperous city for all of us.

Climate Resilient SD will serve as the City's comprehensive plan to prepare for and respond to climate change hazards that threaten our communities, including wildfires, drought, extreme heat, and flooding. As our country has witnessed in recent months, extreme weather driven by a

changing climate can have devastating effects. While these threats aren't new to San Diego, science tells us that climate change is making these events more frequent and intense. The cost of inaction would be far greater than investing in our future.

Historically underserved communities are already experiencing the greatest impacts of climate change. Pursuing environmental justice requires that we acknowledge these disparities and focus our efforts in frontline communities. Prioritizing our actions and investments to protect the most vulnerable communities and address longstanding inequities is a core focus of Climate Resilient SD.

This moment calls for a paradigm shift in how we build climate-ready communities. And while there will be challenges, there are also so many opportunities - to enhance San Diegans' quality of life, build more green spaces, harness the power of clean energy and accelerate the growth of our innovative cleantech economy to keep San Diego on the cutting edge.

Climate Resilient SD will uplift these people-centered solutions to ensure we can all thrive for generations to come. The strength San Diegans have shown in the face of recent adversity makes me certain of this: we are resilient, and together we can create a stronger San Diego.

Sincerely,

A handwritten signature in blue ink that reads "Todd Gloria".

TODD GLORIA

Mayor
City of San Diego

Acknowledgements:

Mayor:

Todd Gloria

City Council:

Joe LaCava, District 1
Jennifer Campbell, District 2
Stephen Whitburn, District 3
Monica Montgomery Steppe, District 4
Marni Von Wilpert, District 5
Chris Cate, District 6
Raul Campillo, District 7
Vivian Moreno, District 8
Sean Elo-Rivera, District 9

Planning Commission:

William Hofman, Chairperson
James Whalen, Vice-Chairperson
Douglas Austin
Ken Malbrough
Dennis Otsuji
Matthew Boomhower
Kelly Moden

City Attorney:

Corrine Neuffer, Deputy City Attorney

Planning Department:

Michael Hansen, AICP, Planning Director
Nicole Darling, Director, Communications Department
Tom Tomlinson, Assistant Director
Heidi Vonblum, Deputy Director
Julia Chase, Senior Planner
Jordan Moore, Senior Planner

Contributors:

Nicole Darling, Communications Department
Andy Field, Director, Parks and Recreation Department
Alyssa Muto, Director, Sustainability and Mobility Department
Casey Smith, Director, Fleet Operations
Raul Gudino, Deputy Director, Library
Brad Hawthorne, Deputy Director
Mark Nassar, Deputy Director, Engineering and Capital Projects Department
Jorge Rubio, Deputy Director, Department of Real Estate and Airport Management
Myrna Dayton, Assistant Director, Engineering and Capital Projects Department
Karen Dennison, Assistant Director, Parks and Recreation Department
John Stufflebean, Assistant Director, Public Utilities Department
Keli Balo, Assistant Deputy Director, Public Utilities Department
Sumer Hasenin, Assistant Deputy Director, Stormwater Department

Honoring the land's original stewards:

The City of San Diego acknowledges that we are on the traditional territory of the Kumeyaay, Luiseño, Cupeño and Cahuilla.

Today, the Kumeyaay people continue to maintain their political sovereignty and cultural traditions as vital members of the San Diego community. We are honored to share this space with them and we thank them for their stewardship.

Contributors continued:

Elizabeth Studebaker, Assistant Deputy Director, Economic Development Department
Alejandra Gavaldon, Strategic Program Manager, Stormwater Department
Amber Hill, Program Coordinator, Office of Emergency Services
Maureen Hodges, Marine Safety Captain, Fire-Rescue Department
Christine Jones, Chief of Civic Arts Strategies, Commission for Arts and Culture
Tara Lewis, Senior Public Information Officer, Communications Department
Rebecca Newell, Battalion Chief, Emergency Operations, Fire-Rescue Department
Donny Nguyen, Program Manager, Fleet Operations
Ashley Rosia-Tremonti, Program Manager, Sustainability Department
David Reed, Program Manager, Department of Real Estate and Airport Management
Marisol Valdovinos, Senior Management Analyst, Debt Management
Brian Widener, City Forester, Transportation Department
Tina Williams, Captain, San Diego Police Department
Michelle Abella-Shon, Project Officer II, Parks and Recreation Department
Gary Chui, Senior Traffic Engineer, Transportation Department
Kristy Forburger, Development Project Manager III, Planning Department
Moriah Saldaña, Project Coordinator, Sustainability and Mobility Department
Kelley Stanco, Development Project Manager III, Planning Department
Sarah Brower, Senior Planner, Public Utilities Department
Jane Fajardo, Senior Planner, Environmental Services Department
Myra Herrmann, Senior Planner, Planning Department

This page intentionally left blank.





Contents

1.0 Our Resilient City	1
2.0 What We Have	7
3.0 What We Face	19
4.0 How We Will Thrive	39
Appendices	63
Appendix A: Adaptation and Resilience Strategies	
Appendix B: Climate Change Hazard Vulnerability Assessment	
Appendix C: Coastal Erosion Assessment	
Appendix D: Draft Local Coastal Program Policies	



1.0 Our Resilient City

A resilient San Diego that can adapt to, recover from and thrive under changing climate conditions



Our Resilient City

What is climate resilience for San Diego?

Resilience is the capacity to respond to and recover from climate change hazard events and trends and maintain essential services, while also providing new equitable opportunities for a thriving future.

Purpose

Climate Resilient SD is a framework for the City of San Diego to prepare for a changing climate that will:



Identify projects, policies and programs to improve daily life for San Diegans



Prioritize, protect and uplift the City's most vulnerable communities



Implement the Climate Action Plan Strategy 5 to comprehensively plan for a changing climate



Protect the City's biodiversity



**Implement State legislative requirements
(Senate Bill 379)**

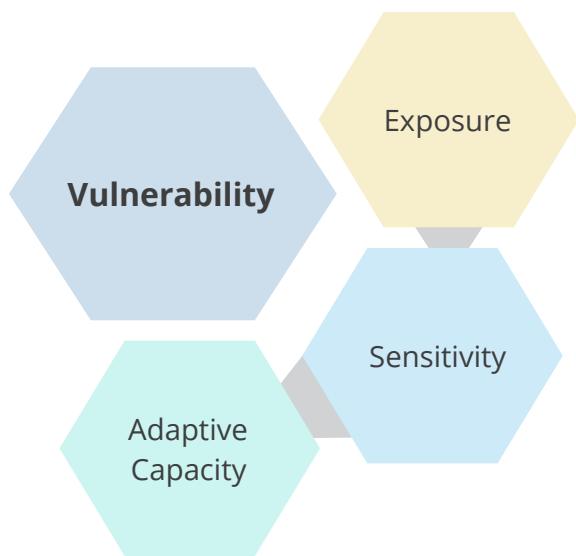


At its core, *Climate Resilient SD* is a plan for the people of the City of San Diego (City) to thrive. Climate change is already impacting our city and can be felt in the daily lives of residents. We experience days of extreme heat, have intense rainstorms that can leave streets flooded and breathe air impacted by wildfire smoke. These impacts are not felt equally across all our community members, with some communities experiencing the impacts more strongly, with fewer resources to prepare and respond. Socially vulnerable populations face disproportionate and unequal risk to climate change, including exposure to particulate air pollution, flooding, and extreme heat exposure^{xxvi}. In recognition of this, *Climate Resilient SD* focuses on how we can protect those most vulnerable to climate change and improve the lives of the people in our city while preparing for a changing climate.

Climate Resilient SD is a comprehensive climate adaptation and resilience plan that addresses the four primary climate change-related hazards for the City: extreme heat, extreme rainfall or drought, wildfires and sea level rise. The level of impact these climate change hazards will have on the City's people, assets and resources was assessed through a detailed citywide Climate Change

Hazard Vulnerability Assessment (Appendix B). This assessment considered exposure to the hazard, sensitivity to the hazard and to what extent the asset or resource could adapt to the hazard.

By identifying its more vulnerable communities, assets and resources, the City can implement adaptation strategies where they are most needed and use its resources most effectively. Adaptation strategies can lessen vulnerability by reducing exposure or sensitivity to climate change hazards, or by increasing their adaptive capacity, or ability to respond to the climate change hazard.



Climate adaptation and resiliency strategies can also focus on increasing community resilience, or the ability to bounce back—and forward—after a climate event. *Climate Resilient SD* is a framework for action that includes a range of adaptation strategies to minimize risk and increase the resilience of San Diego's people, assets, economy and natural resources to climate change.

MITIGATION VS. ADAPTATION

Climate change mitigation aims to reduce greenhouse gas emissions, slow down global warming, and avoid the worst potential impacts of climate change. This is the major goal of the City's Climate Action Plan.

The objective of climate change adaptation, on the other hand, is to reduce impacts from climate change-related hazards. *Climate Resilient SD* is the City's comprehensive adaptation and resilience plan that focuses on increasing local capacity to adapt, recover and thrive in changing climate.

Adaptation addresses a global problem: climate change. Yet, it also requires solutions that must consider local conditions, such as San Diego's social fabric, natural environment and local economy. A fundamental principle of *Climate Resilient SD* is that locally based, community grounded solutions will be the most effective in preparing San Diego for a changing climate. Public input—throughout the development of the plan and continuing into future implementation—is essential to shaping the plan and ensuring that the identified strategies address the community's needs.

Climate Resilient SD looks at how climate change will impact San Diegans now, and into the future.

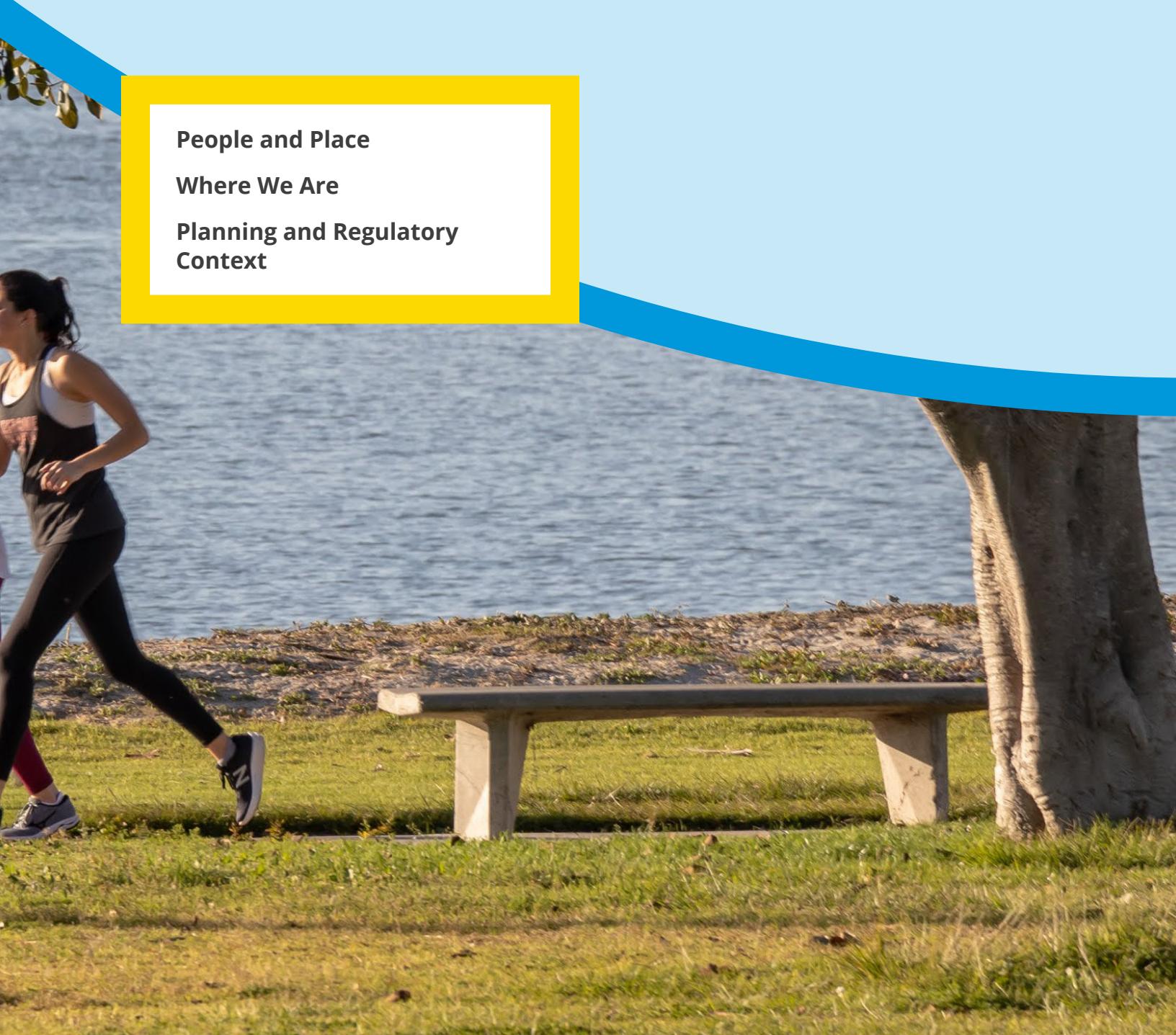
The plan considers how to best plan for vibrant communities, how to protect the environment and how to prosper in the emerging economy. *Climate Resilient SD* includes a suite of goals, policies and strategies that have been shaped by public input. **Goals** reflect the broader vision for San Diego as we look to the future. **Policies** help to guide implementation actions and reflect the City's values and priorities. **Strategies** are implementation actions to prepare the City for climate change impacts and build more resilient communities. The strategies included are intended to provide flexibility in implementation, to allow the City adjust implementation with changing climate conditions and to prioritize action based on community needs. *Climate Resilient SD* is also intended to be a living document, its implementation shaped by continued community engagement and active involvement in plan implementation.







2.0 What We Have



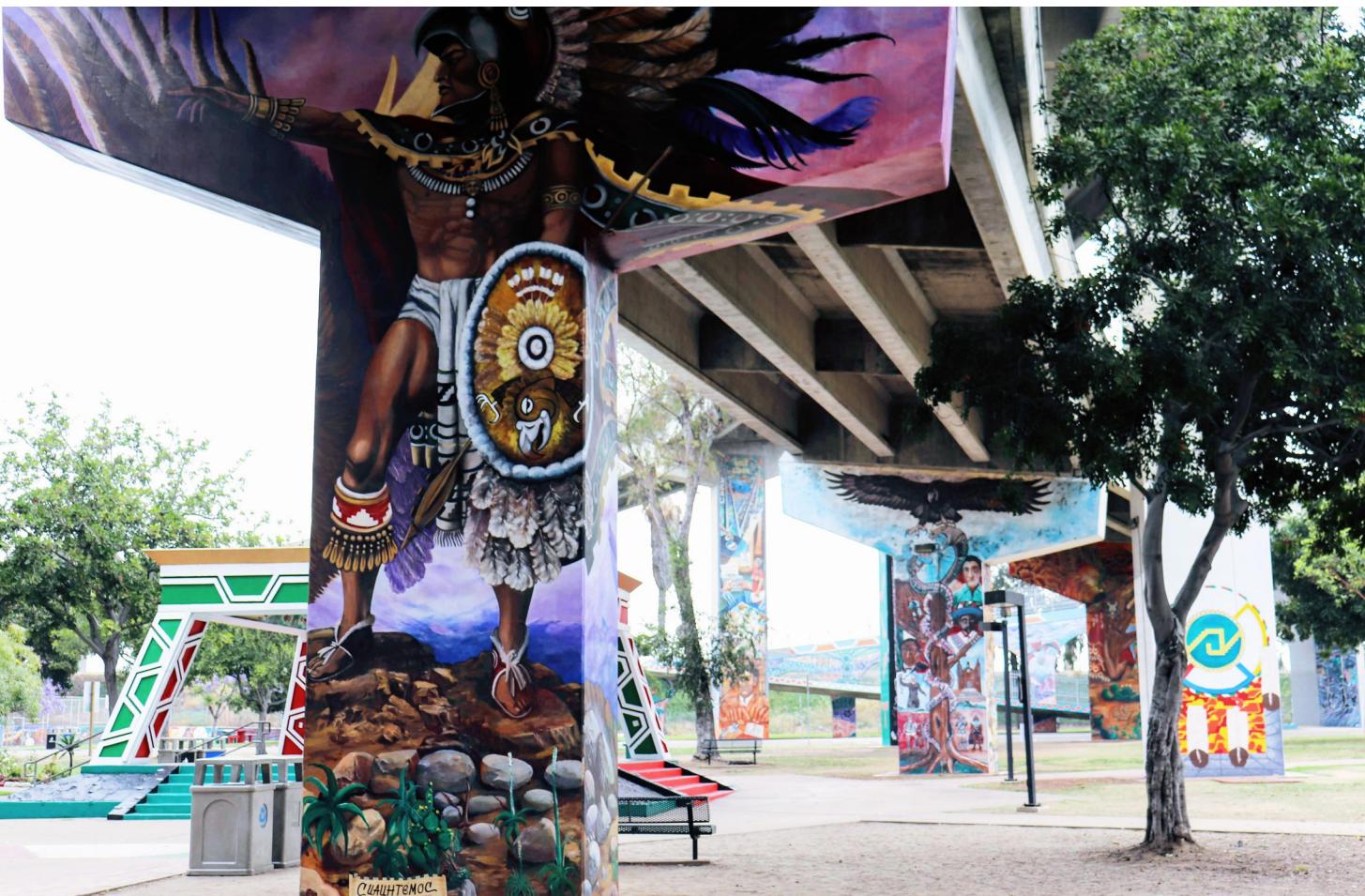
A photograph of a woman jogging on a paved path next to a large body of water. She is wearing a white tank top and dark leggings. In the foreground, there is a yellow rectangular box containing text. A blue diagonal bar runs from the top left towards the bottom right, partially covering the box.

- People and Place**
- Where We Are**
- Planning and Regulatory Context**

What We Have

People and Place

The City of San Diego is well known for its wonderfully diverse people and communities and for its high quality of life. As the second largest city in California, San Diego is currently home to approximately 1.4 million people. The first inhabitants of this area were the Kumeyaay and Luiseño peoples, whose ancestors resided here long before the Spanish arrived in the 18th century and whose descendants are still here today.





Tribal History and Knowledge

The Kumeyaay and Luiseño people have inhabited the San Diego region throughout time. Historically, local tribes have had a deep connection with the land, with a hunting and gathering economy based on various plant resources. The tribes' knowledge and traditions have been passed down through generations, creating a deep understanding of the land and how to manage natural resources through fluctuations in climate conditions. Today, the tribes continue to have a strong relationship with the land and have completed plans that address climate change impacts to their land and communities.

Some examples of the exemplary work completed include:

- The Manzanita Band of the Kumeyaay Nation's Tribal Resilience Project is centered around the sacred relationship between the Kumeyaay and the 'snyaw (Coast Live Oak) and investigates climate change scenarios with natural resources as the main focus.
- The La Jolla Band of Luiseño Indians' Adaptation Plan, a living document first created in 2019, has a strong focus on the relationship that tribal members have with the natural environment around them. The plan identifies climate change-related risks as well as actions that can be taken to adapt and safeguard the La Jolla Tribe's past, present and future.

Local Native American tribes, like the Kumeyaay and Luiseño Bands, discussed above, are recognized as environmental specialists because of their deep understanding and knowledge of the environment. Their holistic approach to managing the land has enabled them to survive in the San Diego region over time. These local tribes have extensive knowledge regarding natural resource management by respecting Mother Earth and continuing to understand their role in maintaining a balance between traditional knowledge and a sustainable environment. Their viewpoints and guidance can provide great value to the region and should be given appropriate recognition.

CASE STUDY



Studying Climate Impacts on Cultural Resources within the California Coastal National Monument

The California Coastal National Monument (CCNM) provides an example of how climate change impacts can be considered in cultural resources management. The CCNM spans the entire length of the California coastline and includes many cultural resource sites. In order to learn more about the impacts that climate change is having on these sites, the Bureau of Land Management has partnered with Sonoma State University and the Society for California Archaeology to create a pilot project that will identify and study the impacts of climate change on coastal cultural resources located within the CCNM. This project will include volunteer field surveys and the preparation of a general workplan that other institutions can use for research grant proposals that study the impacts of climate change on the coast.

Source: National Park Services' Cultural Resources Climate Change Strategy document

Photo: California Coastal National Monument: State Park Lands adjacent to Cotooni-Coast Dairies public lands.

Photo Credit: Bureau of Land Management

Over the past few centuries, many other residents and visitors have also been drawn to enjoy the City's temperate climate. San Diego has grown into a City that boasts 17 miles of coastline and a strong economy built on these four key base sectors: innovation and manufacturing, tourism, military, and international trade. Around thirty percent of the City's residents are Hispanic or Latinx, while roughly one-sixth are Asian and a little more than half are White. More than forty percent of San Diegans speak a language other than English at home. San Diego's temperate climate has made it possible for many rare, threatened and endangered plant and animal species to thrive.

The impacts of a changing climate present serious challenges to all who call San Diego home. Extreme heat, changes in precipitation, wildfire, and sea level rise pose risks to the City's residents, infrastructure and natural environment. These climate hazards could also affect San Diego's economy, as key base industries such as tourism could be particularly impacted by climate change.

The City has taken steps to mitigate these impacts to preserve the natural diversity of our region, and to improve residents' quality of life. Several City plans already contain goals and policies that support the City's resilience efforts. Resilience goals and policies can be found in the City's General Plan, Climate Action Plan; Parks Master Plan; and Local Hazard Mitigation Plan.

Climate Resilient SD builds upon the City's existing policies to provide a comprehensive framework for action to mitigate the risks posed by climate change, and plan for a more resilient future.

PUBLIC FACILITIES, SERVICES AND SAFETY ELEMENT (SAFETY ELEMENT)

The Safety Element includes many climate related policies. It addresses facilities and services that are publicly managed and have a direct influence on the location of land uses, including Fire-Rescue, Police, Wastewater, Storm Water, Water Infrastructure, Waste Management, Libraries, Schools, Information Infrastructure, Disaster Preparedness and Seismic Safety.



Where We Are

CLIMATE TIMELINE



2003 Cedar Fire

Destroyed over 280,000 acres and 2,820 buildings and killed 15 people. This was the largest wildfire in California history, as well as one of the deadliest and most destructive.



2007 Witch Creek/ Guejito Fire

Burned over 197,990 acres and 1,141 homes. These fires triggered the largest evacuation in County history. More than 500,000 people lived in the areas evacuated, 200,000 of them within the City of San Diego.



October 2015 Heat Wave

Over the course of several days, record high temperatures were reached in San Diego and other Southern California cities. This includes the top three warmest low temperatures in October dating back to 1875.



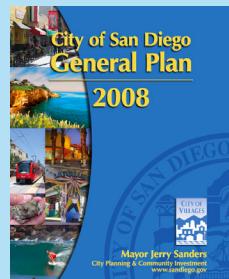
Winter 2016/2017 Rainfall

Wettest winter in over 122 years of record keeping for San Diego, leading to flooding and traffic problems across the region.



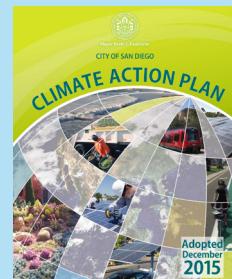
2005 Climate Protection Action Plan

The City of San Diego's first Climate Action Plan is approved in July 2005.



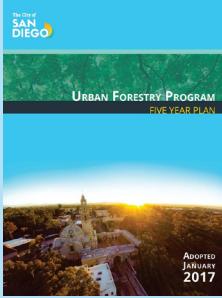
2008 Commitment to Update Climate Action Plan

The City of San Diego commits to updating and implementing its Climate Action Plan in its General Plan Update.



December 2015 Climate Action Plan Approved

The City of San Diego's 2015 Climate Action Plan sets ambitious goals to reduce greenhouse gas emissions and wins unanimous approval from the City Council.



2017 Increase in Urban Tree Canopy

The City of San Diego's Climate Action Plan Annual Report reveals that the City's urban tree canopy cover has increased to 13% over the last seven years, and the City adopts a Five-Year Plan for its Urban Forestry Program to provide.



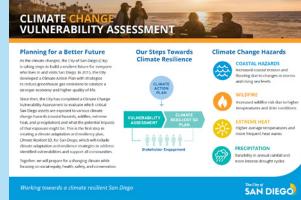
January 2019 King Tides

10-to-12 foot waves on January 18 lead to flooding in coastal communities, as well as causing severe damage to the Ocean Beach Pier, which had to be closed for repairs.



July 2019 AB691 State Land Sea Level Rise Vulnerability Assessment

The City of San Diego completed a state lands sea-level rise vulnerability assessment, evaluating the impacts of sea-level rise on its public trust lands and detailing a plan to address vulnerabilities and mitigate impacts.



March 2020 Citywide Climate Hazard Vulnerability Assessment

The City of San Diego completes a comprehensive Climate Change Hazard Vulnerability Assessment that considers the potential risks and consequences of wildfire, extreme heat, sea level rise, and precipitation-driven flooding to the City.



August 2019 Emergency Stabilization

City of San Diego crews complete emergency construction to stabilize Cooks Crack Sea Cave, after weaknesses were identified in the cave, due in part to coastal erosion, that could affect the street above.



December 2019 Sea Level Rise Vulnerability Assessment

The City of San Diego releases its Sea Level Rise (SLR) Vulnerability Assessment. The SLR Vulnerability Assessment presents key findings on the exposure, sensitivity, and adaptive capacity of critical built, natural, and cultural assets to coastal hazards.



2021 San Diego Community Power

The City moves forward with San Diego Community Power, a Community Choice Aggregator, to help the City achieve 100% renewable energy.

Planning and Regulatory Context

Climate Resilient SD is shaped by existing laws and policies and establishes new policies intended to be relied upon moving forward with implementation to achieve the City's vision for an equitable and resilient City.

STATE

Senate Bill 379

California Senate Bill 379 (SB 379), mandates that each local jurisdiction review and update its General Plan Safety Element by Jan. 1, 2022, to address applicable climate adaptation and resiliency strategies. Among other requirements, Senate Bill 379 requires a vulnerability assessment, a set of adaptation and resilience goals, policies and objectives, and a set of feasible implementation measures. *Climate Resilient SD* will

include an update to the City's General Plan and meet the legislative requirements of SB 379.

Senate Bill 1035

California Senate Bill 1035 (SB 1035) requires that each local jurisdiction reviews and, if necessary, revises its General Plan Safety Element upon each revision of the General Plan Housing Element or local hazard mitigation plan. This must be done at least once every eight years to identify new information relating to flood and fire hazards and climate adaptation and resiliency strategies that were not available during the previous revision of the Safety Element. *Climate Resilient SD* will be updated regularly, at a minimum every five years, in compliance with SB 1035.



LOCAL

Climate Action Plan

The City of San Diego's 2015 Climate Action Plan calls for promoting the City's prosperity and quality of life by building communities that are resilient to climate change, while also recognizing some degree of climate change will occur while the City actively works to reduce and mitigate greenhouse gas (GHG) emissions. *Climate Resilient SD* implements Strategy 5 of the Climate Action Plan, which identifies the need for a standalone climate adaptation plan that integrates and builds upon the strategies and measures in the Climate Action Plan. The Climate Action Plan is concurrently being updated, providing the opportunity for the City to align its climate mitigation and climate adaptation efforts.

San Diego County Multi-Jurisdictional Hazard Mitigation Plan

The San Diego County Multi-Jurisdictional Hazard Mitigation Plan (Hazard Mitigation Plan) was last revised in 2018. The City of San Diego contributes to this plan by providing information on the City's critical facilities and potential exposures and losses related to climate change hazards. These climate change hazards include coastal storms

and erosion, sea level rise, floods, rain-induced landslides, wildfire and non-climate-related hazards such as earthquakes, dam failures and tsunamis. The City's portion of this plan includes six hazard mitigation goals, along with objectives and prioritized action items to achieve them. The Hazard Mitigation Plan's mitigation goals, objectives and actions help inform the City's climate resiliency planning.

City of San Diego General Plan

The City of San Diego's General Plan is composed of 10 elements that provide a comprehensive slate of citywide policies and further the City of Villages smart-growth strategy for growth and development. One element of the General Plan is the Public Facilities, Services, and Safety Element (Safety Element), the purpose of which is to protect the community from unreasonable risks associated with the effects of geologic hazards, flooding, and wildland and urban fires. In 2018, the City's Safety Element was amended to include goals and policies that address the risk of wildfire in fire-hazard severity zones.



GUIDANCE DOCUMENTS

- **The Governor's Office of Emergency Services' California Adaptation Planning Guide (APG) 2.0 (2020)** provides guidance for local jurisdictions to address climate change impacts. This latest version of the adaptation planning guide reflects current best practices; integrates recent updates to state plans, policies, programs and regulations; and ensures communities have guidance on using the best available science and information.
- **The Governor's Office of Planning and Research, California Natural Resources Agency, and California Energy Commission's California's Fourth Climate Change Assessment (2018)** was designed to address critical information gaps that decision-makers need at the state, regional and local levels to protect and build resilience of California's people and its infrastructure, natural systems, working lands and waters. This updated assessment draws on the best available science, and includes a wide-ranging body of technical reports, including comprehensive climate change scenarios at a scale suitable for illuminating regional vulnerabilities and localized adaptation strategies in California; datasets and tools that improve integration of observed and projected knowledge about climate change into decision-making; and recommendations and information to directly inform vulnerability assessments and adaptation strategies for California's energy sector, water resources and management, oceans and coasts, forests, wildfires, agriculture, biodiversity and habitat, and public health. The City has relied on the Fourth Climate Change Assessment, including its specific San Diego Region Report (discussed next), to reference the best available research on climate change as well as potential adaptation strategies.
- **The Governor's Office of Planning and Research, California Natural Resources Agency, and California Energy Commission's San Diego Region Report (2018)** was developed as part of a series of regional reports included in California's Fourth Climate Change Assessment, and includes an overview of climate science, specific strategies to adapt to climate impacts, and key research gaps needed to spur additional progress on safeguarding the San Diego region from climate change.
- **The California Natural Resources Agency's Safeguarding California (2018)** is the State's roadmap for state agencies to protect communities, infrastructure, services, and the natural environment from climate change impacts. This resource helps coordinate adaptation with state efforts and find examples of adaptation strategies.
- **The California Ocean Protection Council and California Natural Resources Agency's State of California Sea-Level Rise Guidance (2018)** provides guidance on the best available science on sea level rise projections and rates for California, a stepwise approach for state agencies and local governments to evaluate those projections and related hazard information in decision making, and preferred coastal adaptation approaches.
- **The California Coastal Commission's Sea Level Rise Policy Guidance (2018)** provides the best available science on sea level rise specific to California, paired with a recommended methodology for addressing sea level rise in Coastal Commission planning and regulatory actions, which informed the vulnerability assessment for sea level rise for the City.





3.0

What We Face



Wildfire
Heat
Sea Level Rise & Coastal Flooding
Coastal Erosion
Extreme Rainfall & Droughts
Climate Change Vulnerability Assessments

What We Face



Wildfire

Climate change will likely increase the key drivers of wildfires—high temperatures, dry conditions and flammable vegetation.ⁱⁱ Increases in the drivers of wildfires with climate change will lead to wildfires that occur more frequently^v during a longer wildfire season,^{vi} and burn longer and more intensely.^{vii}

The Southwest United States, including California, is expected to experience increased drought with climate change.ⁱⁱⁱ Historically, wildfires have been larger and more severe in areas with intensive drought stress.ⁱ These wildfires were also followed by higher tree mortality, which increases exposure

to more future wildfires. Tree die-off in California has also reached historic highs in recent years due to pine beetles, heat, and drought, which are expected to increase with climate change and provide more fuel for fires.^{iv}

In the San Diego region, wildfire risk is projected to increase, as is the risk of large catastrophic wildfires that arise from Santa Ana winds.^{viii} However, changes in wildfire risks within the City limits is less certain due to uncertainties around urban development and resulting fuel characteristics. For example, there is some uncertainty in wildfire modeling due to different modeling approaches. The Cal-Adapt model assumes that increasing urban development will reduce vegetation cover and fire fuel availability and suggests that only less urbanized areas of San Diego will experience increased wildfire risk in the future. However, other studies predict a universal increase in wildfire risk for our region. San Diego should anticipate wildfire risk to be of equal or greater severity than in recent decades. Additionally, these larger and more frequent wildfires can cause increases in air pollution in the surrounding area and affect regional air quality.

Fire hazard severity zones for San Diego are shown in Figure 1.

● Climate change will lead to wildfires that occur more frequently during a longer wildfire season and burn longer and more intensely.

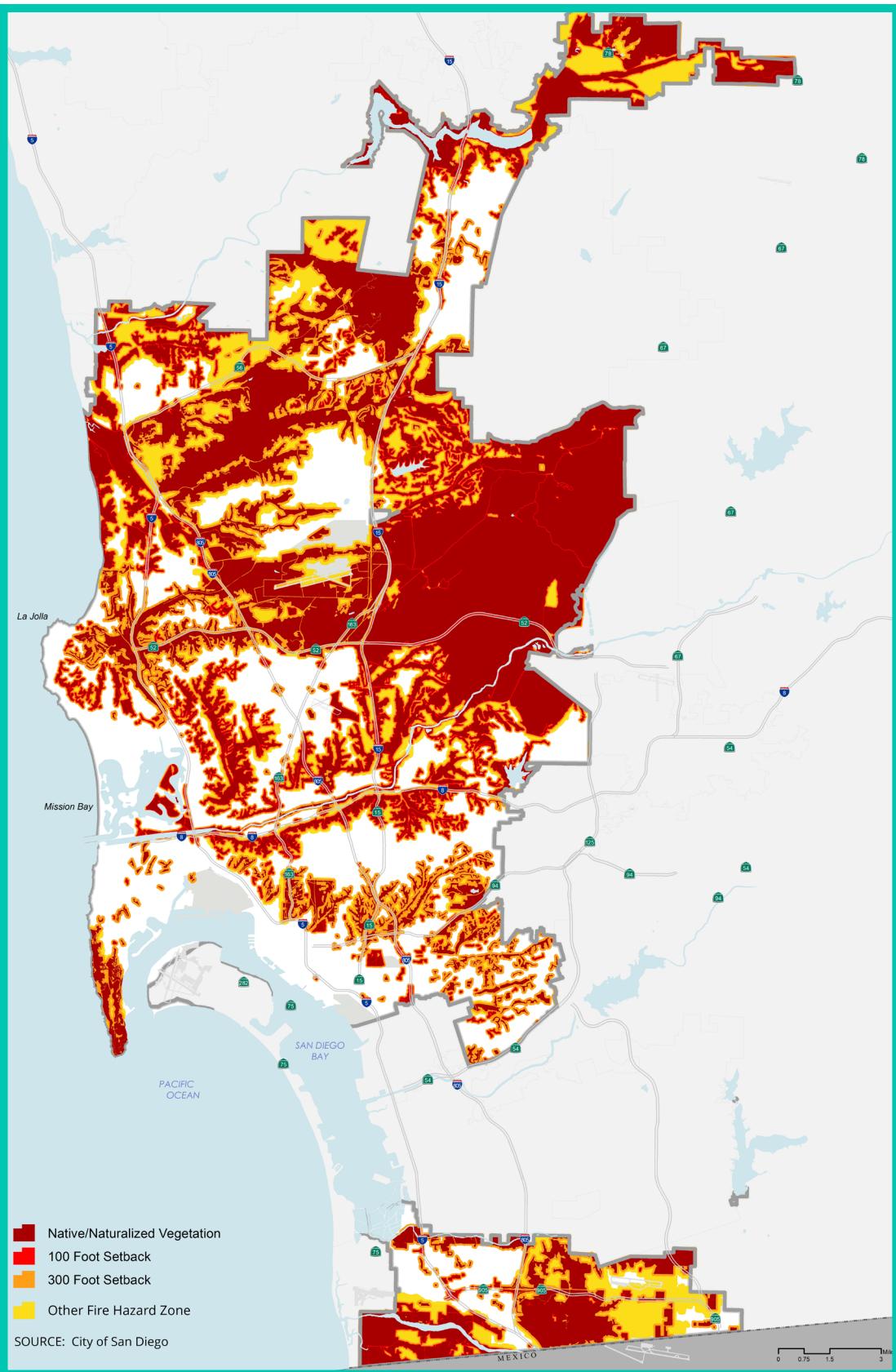


Figure 1: Fire Hazard and Brush Management Areas



Heat

San Diego is known for its pleasant temperatures. In the past, extreme highs (93°F) have only occurred about four days per year. However, those pleasant temperatures are projected to change. By the 2080s, each year could include up to a month with daily highs over 93°F.

As shown in Figure 2, under the high-emissions scenario, by mid-century, heat waves could be occurring three to five times more frequently, and each heat wave could drag out for more than twice as many days.

Additionally, under the high-emissions scenario, the frequency and duration of warm nights are projected to increase substantially in San Diego by mid- to late-century. Warm nights pose a health risk, as they limit nighttime cooling and physiological recovery during heat waves and prolong the period over which heat-driven negative health outcomes can take place^{ix}.

San Diego routinely experiences hot summer days. "Extreme heat" is defined as a day with a maximum temperature exceeding 93.1°F.¹ In the past,² the City has experienced approximately four of these extreme heat days per year. The City, historically, has not been prone to many heat waves, with an average of only one heat wave³ every other year and an average maximum of 2.5 consecutive extreme heat days per year.

Daily minimum temperatures, which generally represent the nighttime low temperature, are important for allowing people and infrastructure to cool off before the start of another day. Historically, the annual average daily minimum temperature for the City has been 52.9°F. Warm nights in San Diego occur when the daily minimum temperature exceeds 67.9°F⁴. There typically has been approximately four warm nights per year in the City, generally in August and September.

¹ More specifically, an extreme heat day is defined as a day in April through October when the maximum temperature exceeds the City of San Diego's 98th percentile of historical maximum temperatures between April 1 and Oct. 31 based on observed daily temperature data from 1961–1990. This threshold for extreme heat days is calculated to be 93.1°F. In other words, historically, this temperature was only exceeded in the City of San Diego two percent of all days.

² Between the years 1960–1990.

³ Heat waves are defined as four-day events where daily maximum temperatures exceed 93.1°F.

⁴ 67.9°F is the 98th percentile historical minimum temperature threshold.

WHAT ARE EMISSIONS SCENARIOS?

The main driver of human-caused climate change is our emissions of carbon dioxide and other greenhouse gases into the atmosphere. Greenhouse gases are named such because they trap heat in the atmosphere, causing it to warm over time. Atmospheric warming in turn leads to other changes throughout the earth's system. How much the climate changes in the future depends in large part on the amount of greenhouse gases we emit now and going forward. However, since our emissions of greenhouse gases depend on a variety of different social, political, and economic factors, we cannot be certain how they will change. But we can use best available science on what potential greenhouse gas emissions may be and use those scenarios to create future climate projections.

The Cal-Adapt tool shows outcomes for two different greenhouse gas scenarios: a high-emissions scenario in which greenhouse gas emissions continue to rise over the 21st century, and a low-emissions scenario in which greenhouse gas emissions level off around the middle of the 21st century and by the end of the century are lower than 1990 levels.

Source: Cal-Adapt (<https://cal-adapt.org/resources/using-climate-projections/>).



FUTURE CONDITIONS

Climate projections indicate San Diego will experience more frequent extreme heat days in the future (see Figure 3). By mid-century,⁵ extreme heat days could increase to 11 days under a low emissions scenario and 15 days under a high emissions scenario. By the late century,⁶ this could further increase to 16 days under the low emission scenario and 32 days under the high emission scenario.^x Heat waves are also projected to increase in frequency,^{xi} duration and magnitude,^{xii} with San Diego projected to experience up to 1.4 more four-day heat waves annually by mid-century, and up to 4.2 more heat waves annually by late century.

As the daily maximum temperatures are projected to increase, so too are the daily minimum temperatures. This will mean warmer nights in San Diego. Under a high emissions scenario, daily minimum temperatures could be 8°F warmer at the end of the century than they are today. The annual number of warm nights is also projected to increase substantially. Warm night projections for San Diego are shown in Figure 4.

By mid-century, under the high emissions scenario, San Diego could experience between three weeks to slightly over a month of warm nights per year. By late century, under the high emissions scenario, the City could experience between a month to more than three and a half months of warm nights per year.

💡 Daily minimum temperatures could be 8°F warmer at the end of the century than they are today.

⁵ Between the years 2035-2064.

⁶ Between the years 2070-2099.

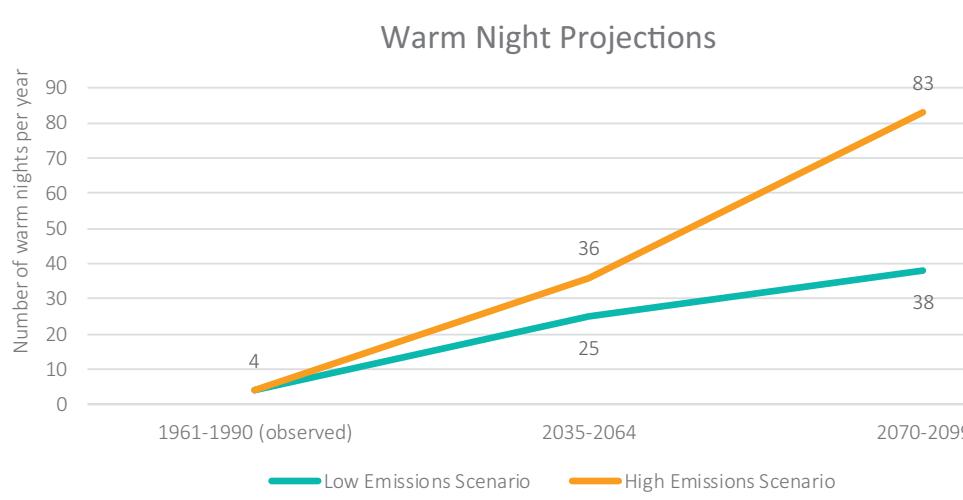
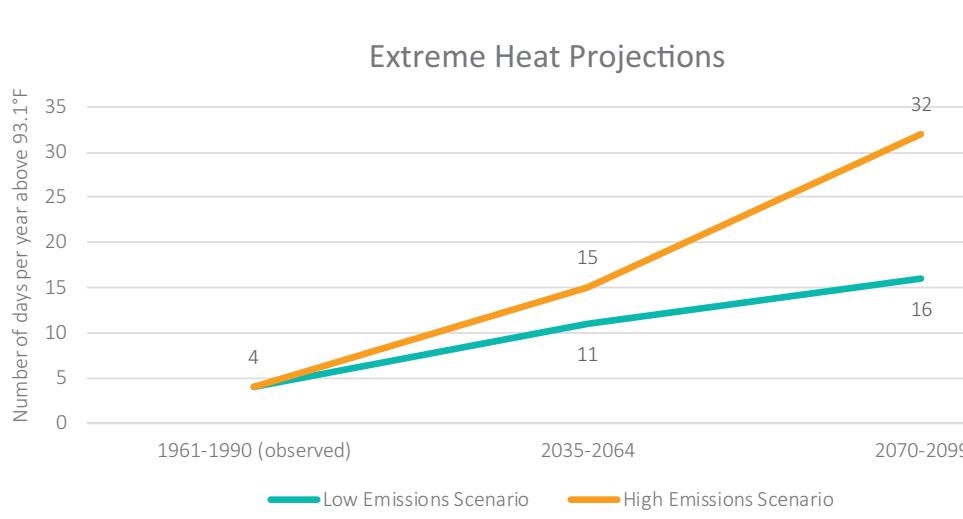
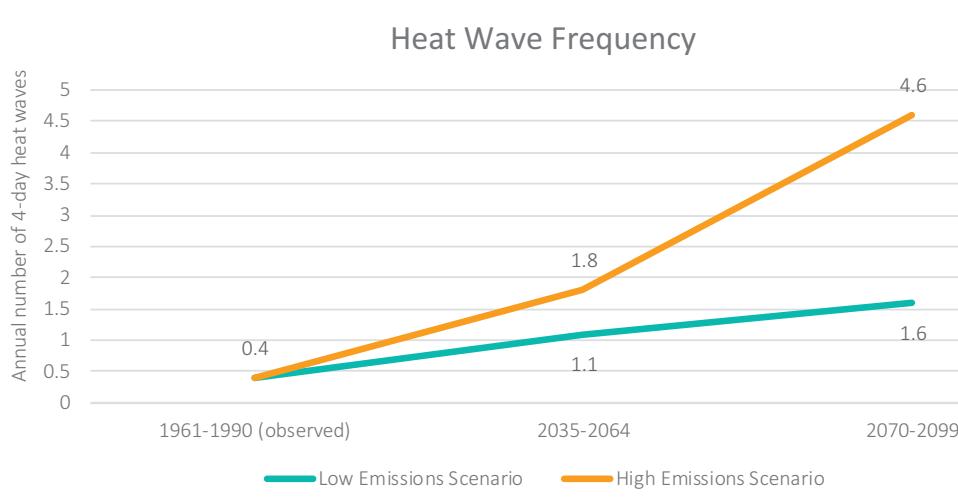


Figure 2: City of San Diego Heat Wave Frequency Projections

Source: Cal-Adapt.org

Figure 3: City of San Diego Extreme Heat Projections

Source: Cal-Adapt.org

Figure 4: City of San Diego Warm Night Projections

Source: Cal-Adapt.org

Sea Level Rise & Coastal Flooding

Sea levels rose 0.71 feet in San Diego during the 20th century (see Figure 5).^{xiii} By the end of the 21st century, San Diego could experience another 3.6 to 10.2 feet of sea level rise. Coastal storms are projected to occur more frequently in the future, which will further exacerbate flooding along the coast.

SEA LEVEL RISE PROJECTIONS FOR SAN DIEGO*

2030: 0.6 to 1.1 feet

2050: 1.2-2.8 feet

2100: 3.6-10.2 feet

*Based on 2018 California Coastal Commission Sea Level Rise Policy Guidance

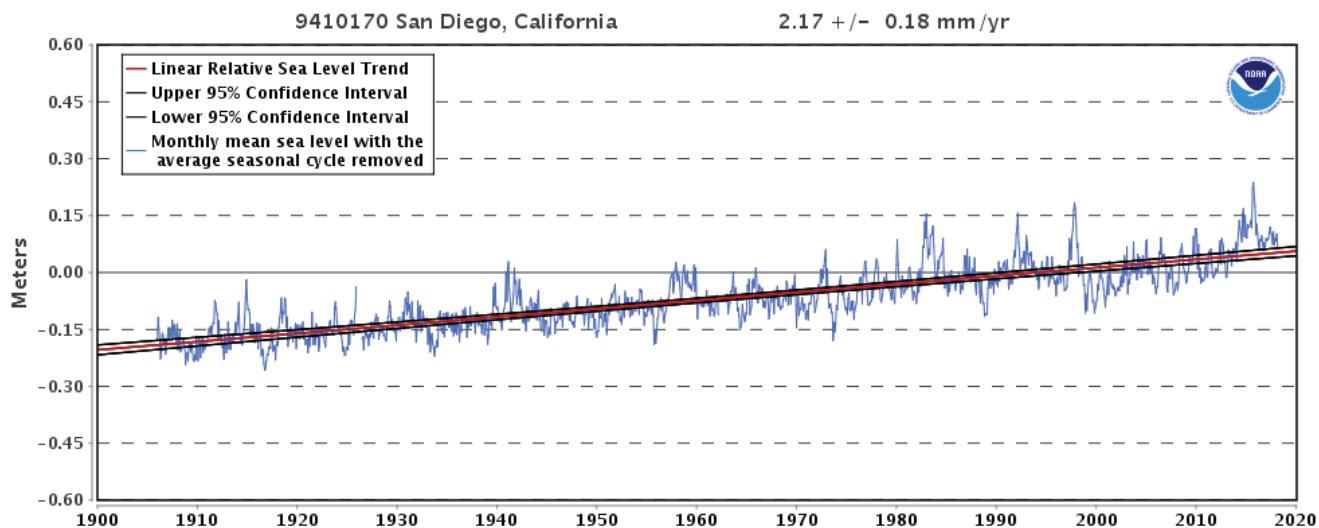


Figure 5: City of San Diego Historical Sea Level (Tide Gauge 9410170)

Source: NOAA 2018

Over the past century, mean global sea level has risen approximately 1.7 millimeters per year, which has accelerated to a rate of 3.2 millimeters per year since 1993.^{xiv} Data from the tide gauge in San Diego⁷ suggests sea level here has risen approximately 2.17 millimeters per year, which is 32% higher than the global rate.^{xv}

Sea levels in San Diego may rise between 1.2 to 2.8 feet by 2050, and 3.6 to 10.2 feet by 2100.^{xvi} This range demonstrates the increasing uncertainty associated with estimating sea level rise in the long term, especially after 2050. The contribution of thermal expansion and melting of small glaciers

to sea level rise is well researched. However, the impact of ice loss from large ice sheets melting in Greenland and Antarctica may soon become the primary contributor to sea level rise.^{xvii} This rise in sea level is projected to accelerate toward the second half of the 21st century (see Figure 6).

The frequency of extreme flooding is also expected to increase under all projections of sea level rise. In addition, rising seas will magnify the occurrence of severe floods (such as the 500-year flood) along the Pacific Coast of the United States.^{xviii} By elevating storm tide, sea level rise makes it easier for waves to surpass natural barriers, increasing the relative frequency of flooding along the coast. It is also possible that rising sea levels could raise groundwater levels, which could resurface toxic contaminants.

⁷ Measured between 1906 and 2017 for these calculations.

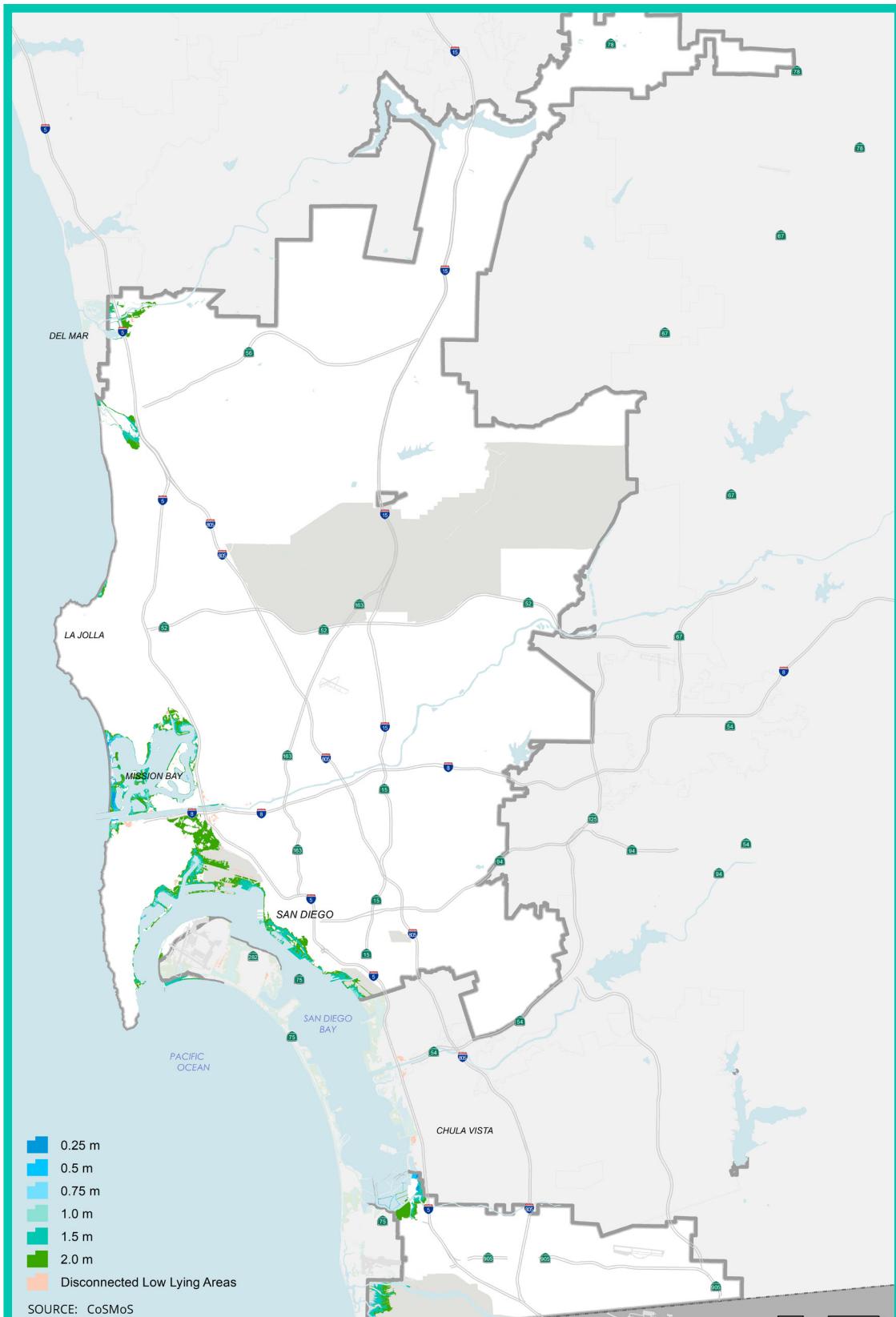


Figure 6. City of San Diego Daily Coastal Flooding
(Flooding data obtained from USGS. Map was created 2021)

Coastal Erosion

Coastal erosion has long been an issue along the San Diego coastline. Locations such as Sunset Cliffs, La Jolla and Torrey Pines have experienced increased coastal erosion over time (Figure 7). With sea level rise and changes in storms, coastal erosion is expected to increase, though there is considerable uncertainty regarding where and when that may occur.

The relatively soft sandstone bluffs that are common along the San Diego coast are prone to erosion from waves and from storm water runoff. Sea level rise, combined with increased storm frequency, may accelerate beach and other coastal shoreline erosion.

Cliff erosion is likely to increase with sea level rise and heavier rainfall events, but modeling when and where can be difficult. Research from Scripps Institute of Oceanography indicates that cliffs cycle through periods of erosion and stability, meaning historic erosion rates are not always an accurate predictor of future erosion.^{xix} Areas that have been stable for some time may start eroding, while areas that have been actively eroding may stabilize. It is hard to predict when and where cliff erosion may slow or accelerate.

Beach erosion is also likely to accelerate with sea level rise. While the City has previously conducted beach nourishment^{xx}, which involves placing additional sediment onto a beach to combat the effects of erosion, it is unlikely that historic rates of nourishment will be enough to stop future beach erosion. A recent study^{xxi} found significant impacts to the shoreline will occur due to accelerated sea level rise, with 31% of beaches in Southern California lost by 2100 under a 3-foot sea level rise projection.



Figure 7: Coastal Erosion Assessment images for Hill Street to Guizot Street from 1993, 2003 and 2018

Source: ICF 2018

Extreme Rainfall & Droughts

Changes in precipitation patterns, which includes extreme rainfall and droughts, is a difficult variable for climate change models to project. More variability in rainfall from year to year is expected along with more intense transitions between droughts and extreme rainfall events.

California can experience wide swings in precipitation from drought years to El Niño years. But over the last 80 years,⁸ the average rainfall in San Diego⁹ has been about 10.13 inches annually.^{xxii}

Annual average precipitation values from Cal-Adapt and other sources project only small changes^{xxiii} in average annual rainfall (see Figure 8) for Southern California. However, there is expected to be greater variability in precipitation, and more intense transitions between dry and wet years. There may be more extreme dry years that are followed by extremely wet years, as recently occurred in 2015 to 2016 and 2016 to 2017.^{xxiv} Extreme precipitation events, which historically occurred about every 25 years on average, are also expected to become 2.5 times more frequent in Southern California.^{xxv} This implies that what we experience as extreme now will be considered the norm in the future. These heavier rainfall events will expand existing inland flooding areas (shown in Figure 9) and create new ones.

i **Extreme precipitation events are also expected to become 2.5 times more frequent in Southern California.¹**

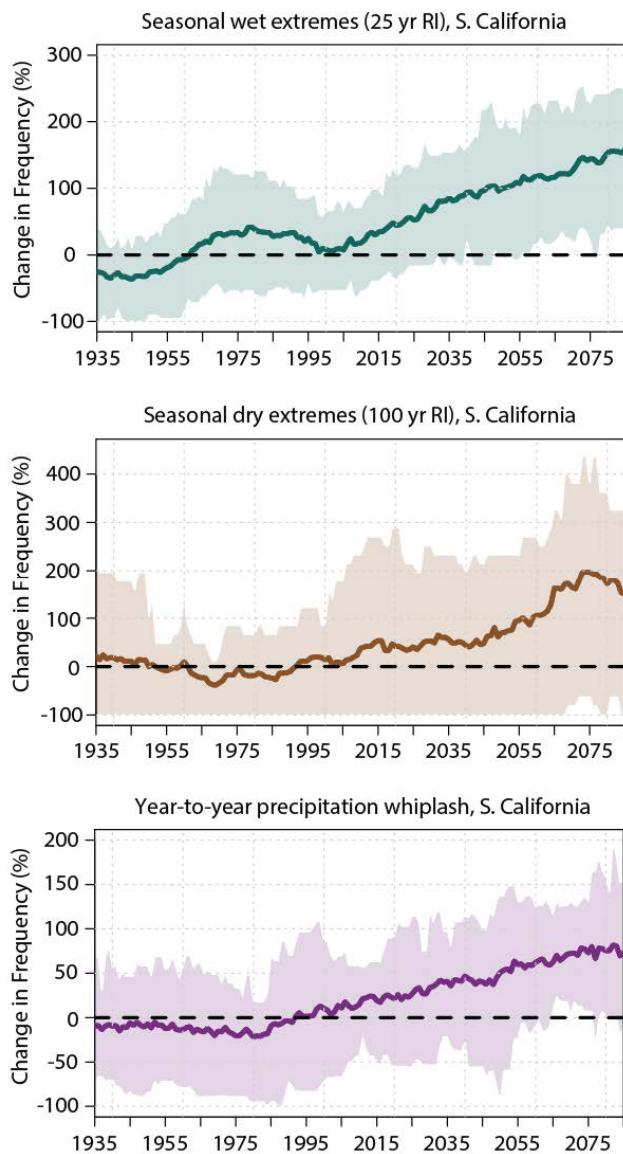


Figure 8: Precipitation Changes in Southern California

Source: Swain et al. 2018

⁸ Between 1939 and 2016.

⁹ As recorded at San Diego International Airport.

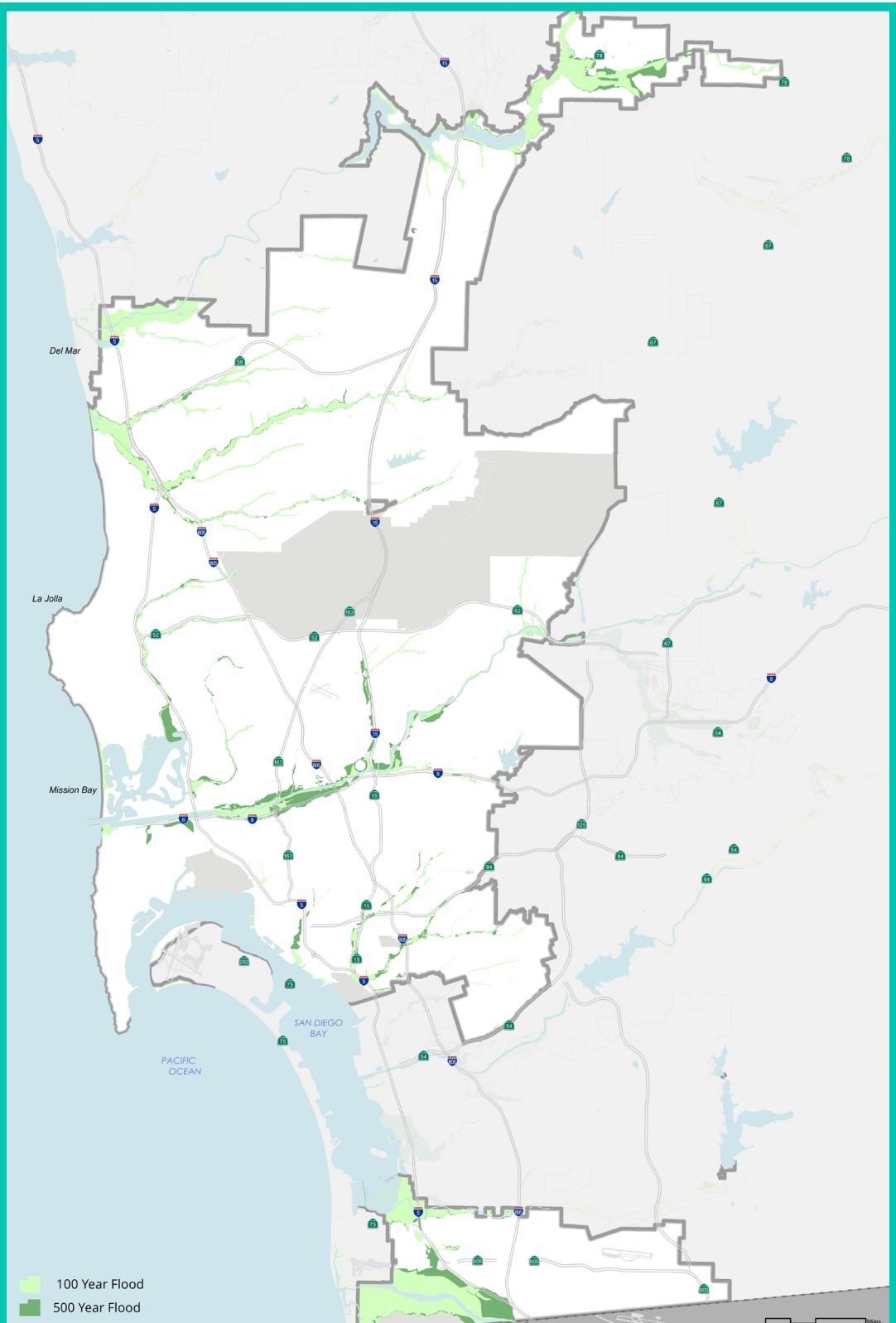


Figure 9: City of San Diego Floodplains

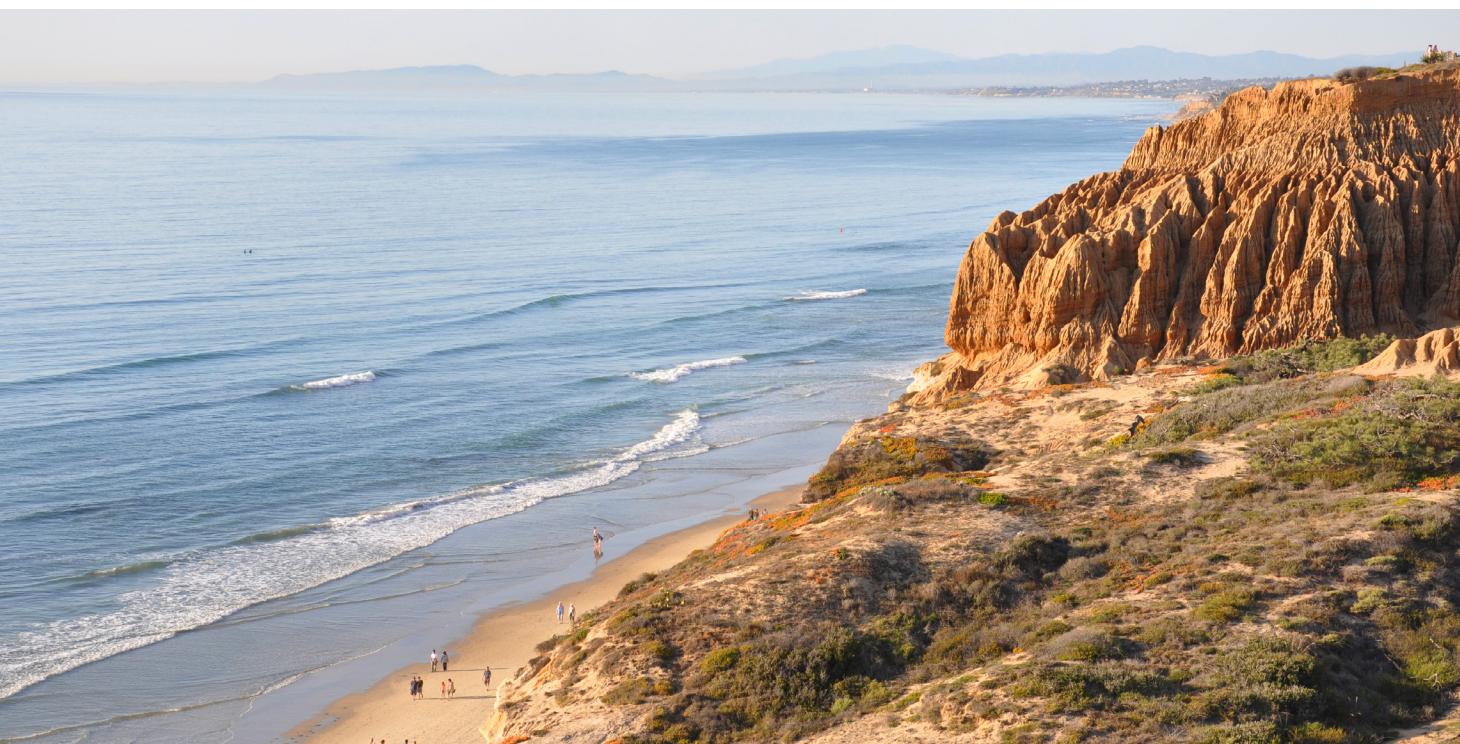
(FEMA Floodplain data, 2019)

Climate Change Vulnerability Assessments

Based on projected future conditions resulting from climate change, identifying San Diego's vulnerabilities to these conditions is essential to an informed and intentional approach to ensuring San Diego's resiliency. Several climate change vulnerability assessments have been completed, each of which has informed *Climate Resilient SD*'s resiliency strategies.

COASTAL EROSION ASSESSMENT

The City of San Diego's Coastal Erosion Assessment, which was last updated in September 2018, monitors 71 sites along the City's 17-mile shoreline. These sites include bluff-top linear parks, bluff-top streets paralleling the coastal bluff and City streets that end at the bluff edge. A system of photographs, risk ratings and site notes for each site in the original assessment was designed to help the City identify and prioritize which coastal areas need remediation. The Coastal Erosion Assessment updates have monitored the conditions and changes of these sites over time.



The most recent update found that five sites showed obvious improvement in terms of risk, predominantly due to the City's efforts to mitigate signs of erosion and risks to pedestrians at these locations. Twelve of the sites showed evidence of increased erosion and increased risk to pedestrians. The most

common problems identified at these sites included risks to pedestrian staircases, collapsing bluffs, potential weakening of sea-cave arches and lack of pedestrian access ways in some areas. See Appendix C, Coastal Erosion Assessment.

ASSEMBLY BILL 691 VULNERABILITY ASSESSMENT

The City of San Diego's AB 691 Vulnerability Assessment, which was completed in July 2019, presents a sea level rise (SLR) vulnerability assessment for the City of San Diego's granted lands in compliance with California Assembly Bill 691. In this report, the City analyzed the risks that sea level rise, storm surge and coastal erosion

pose to City assets and public trust resources, such as parks, coastal habitats and coastal access points, located within granted lands in San Diego. Focused specifically on the granted lands, the assessment identifies vulnerable assets, estimates financial costs and identifies more than 30 potential mitigation and adaptation measures to reduce vulnerabilities.

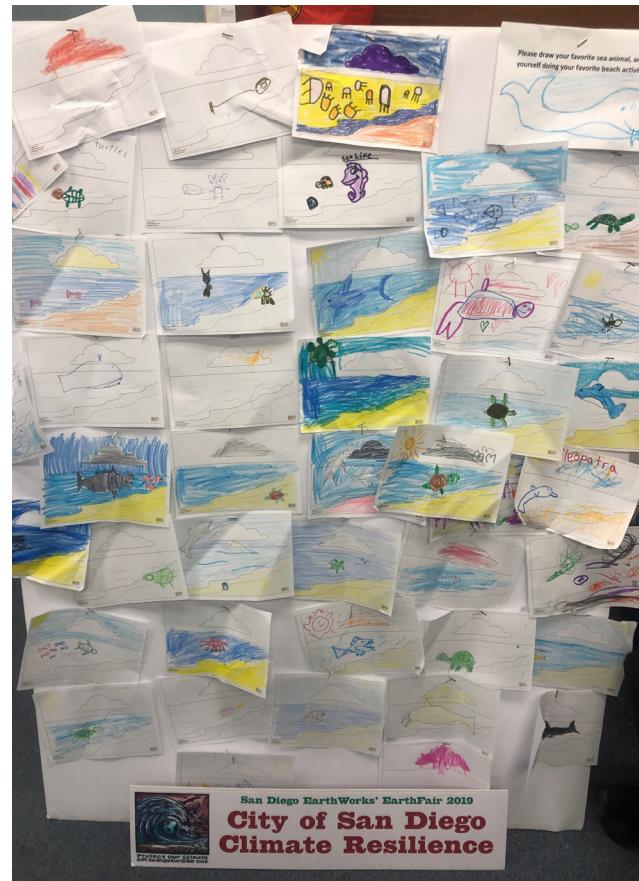


Sea level rise and storm surge pose increasing risks of flooding and erosion to both City-owned and private resources and assets within San Diego's granted lands. Nearly all City asset types within granted lands, including bridges, historic and cultural resources, conservation areas

and parks were ranked as highly vulnerable to sea level rise. Hotels and motels are the most vulnerable non-City assets on granted lands. Cost estimates show sea level rise could have a major impact to assets and resources if no adaptive measures are taken.

SEA LEVEL RISE VULNERABILITY ASSESSMENT

The City of San Diego's Sea Level Rise Vulnerability Assessment is a coastal focused assessment completed in December 2019. The Sea Level Rise Vulnerability Assessment assesses the vulnerability of critical built, natural and cultural assets to coastal hazards, including sea level rise, storm surge and coastal erosion. Vulnerability was scored using exposure, sensitivity and adaptive capacity as determining factors.



The assessment addressed vulnerabilities by City asset type as follows:

- **Public Safety Assets:** Lifeguard stations are highly vulnerable to sea level rise and coastal erosion. Many other assets, such as firetrucks, maintenance facilities and police stations are not exposed, and therefore not vulnerable to sea level rise or storm surge.
- **Water and Wastewater Assets:** Water and wastewater pipes, and water and wastewater pump stations are highly vulnerable to coastal erosion. In this assessment, distribution reservoirs, water and wastewater treatment plants and dams were not found to be exposed to either coastal erosion or sea level rise. Since the Vulnerability Assessment was completed, the City has completed additional analysis to further assess potential impact from coastal hazards to its infrastructure¹⁰. Further analysis found wastewater treatment plants to be highly vulnerable to coastal erosion.
- **Transportation and Stormwater Assets:** Bridges and outfalls are highly vulnerable to both coastal erosion and sea level rise. Drain pump stations are highly vulnerable to sea level rise and storm surge, but not exposed or impacted by coastal erosion.
- **Historic and Tribal Cultural Resources:** These are very sensitive assets and are highly vulnerable to both coastal erosion and sea level rise.
- **Open Space and Environmental Assets:** Recreation centers, community parks, conservation areas, beaches and sensitive habitat are highly vulnerable to sea level rise.

CLIMATE CHANGE VULNERABILITY ASSESSMENT

The City of San Diego's Climate Change Vulnerability Assessment is a citywide assessment completed in February 2020. It assesses the vulnerability of City asset types against four major climate change hazards: changes in the frequency and severity of wildfire; sea level rise and related coastal hazards; changes in precipitation; and

extreme heat events. This report included a high-level vulnerability assessment of 31 critical asset types, using exposure, sensitivity and adaptive capacity to score the vulnerability of each asset type. The assessment also considered potential consequences of climate change hazards for each asset type.



Wildfire was identified as the primary climate change hazard in San Diego, as 20 asset types were found to be highly vulnerable to this hazard. However, all four hazards analyzed pose potential risks to City assets and services.

This assessment also addressed vulnerabilities by City asset type. Findings are summarized below and in Figure 10. For the full citywide vulnerability assessment, see Appendix B, Climate Change Hazard Vulnerability Assessment.

PUBLIC SAFETY ASSETS

- Lifeguard stations are highly vulnerable to coastal erosion and sea level rise, and police stations are highly vulnerable to wildfire. Other assets such as fire logistics and dispatch, and police patrol and specialty vehicles, are not exposed and not vulnerable to many of the assessed climate hazards.
- Damage to these assets could delay response of emergency services, and if some elements of the system are damaged or disrupted, other facilities may be called to serve a larger area.

WATER ASSETS

- Water and wastewater pipes and wastewater pump stations are highly vulnerable to coastal erosion; dams and wastewater pump stations are highly vulnerable to precipitation; and water pump stations are highly vulnerable to wildfire. Other assets such as distribution reservoirs and water treatment plants are not exposed, and not vulnerable to many of the assessed climate hazards. Additional analysis completed since the Vulnerability Assessment also found wastewater treatment plants to be highly vulnerable to coastal hazards.¹⁰
- Damage to these assets could cause flooding, transportation delays or rerouting, and have negative consequences for human health, social equity, and the environment.

TRANSPORTATION AND STORM WATER ASSETS

- Bridges, major arterials, drain pump stations

and outfalls are highly vulnerable to sea level rise; drain pump stations and outfalls are highly vulnerable to sea level rise with storm surge; bridges and outfalls are highly vulnerable to coastal erosion; drain pump stations and outfalls are highly vulnerable to precipitation; and airports, bridges, major arterials and drain pump stations are highly vulnerable to wildfire.

- Impacts to transportation assets could delay emergency vehicles and disrupt daily movement of goods and people, while impacts to storm water assets could exacerbate flooding.

OPEN SPACE ASSETS

- Community parks and beaches are highly vulnerable to sea level rise and to coastal erosion; community parks are highly vulnerable to wildfire; and open space is highly vulnerable to all four of the assessed climate hazards. Other assets, such as Miramar Landfill and CNG Fueling Station, are not exposed and not vulnerable to many of the assessed climate hazards.
- Damage to open space assets could cause habitat loss for many threatened and endangered species, and damage to built infrastructure could affect City services, human health and social equity.

ADDITIONAL ASSETS

- Recreation centers are highly vulnerable to sea level rise, and historical and tribal cultural and archaeological resources are highly vulnerable to all four of the assessed climate hazards. Other assets, such as libraries and City buildings, are not exposed and not vulnerable to many of the assessed climate hazards.
- Impacts to these assets could affect City services and damage historical and cultural resources.

¹⁰ Additional analysis has been completed by the City of San Diego since completion of the citywide Climate Change Hazard Vulnerability Assessment in February 2020. Please see Point Loma Wastewater Treatment Plant Coastal Erosion Assessment and Recommendation (January 2021), and Climate Change Action Plan, Special Studies Requirement VI of Order No. R9-2017-0007 (September 2020).

Vulnerability of Critical Assets to Climate Change

The Vulnerability Assessment identified critical City asset types and analyzed their vulnerability to the climate change hazards. Medium and high vulnerability scores are outlined below. Low vulnerability scores were not included as they are considered to be of lesser concern at this time.

Sectors	Asset Types	Medium Vulnerability	High Vulnerability
Public Safety	Fire Stations	●	
	Police Stations		●
	Lifeguard Stations	● ● ●	● ●
	Maintenance Facilities	● ●	
	Police Patrol and Specialty Vehicles	●	
	Other Public Safety	● ●	●
Water	Dams	●	●
	Water Pipes	● ● ●	●
	Wastewater Pipes	● ● ●	●
	Water Pump Stations	● ●	●
	Wastewater Pump Stations	●	● ● ●
	Distribution Reservoirs	● ●	
	Water Treatment Plants	●	
	Wastewater Treatment Plants	● ●	
Transportation and Storm Water	Airports	●	●
	Bridges	● ● ●	● ● ● ●
	Major Arterials	● ● ● ●	● ● ●
	Drain Pump Stations		● ● ● ● ●
	Outfalls	● ●	● ● ● ●
	Levees	● ●	
Open Space and Environment	Conservation Areas/Open Space/Source Water Land		● ● ● ● ● ● ●
	Community Parks	● ● ●	● ● ● ●
	Miramar Landfill	●	
	Beaches	● ● ●	● ●
Additional Assets	Recreation Centers	● ● ●	●
	Libraries	●	
	City Buildings	●	
	Historical, Tribal Cultural, and Archaeological Resources	●	● ● ● ● ●

Coastal Hazards:

- Sea Level Rise ● Storm Surge ● Coastal Erosion ● Wildfire ● Extreme Heat ● Precipitation

Figure 10: City Asset Vulnerability to Climate Hazards¹¹

¹¹ Additional analysis has been completed by the City of San Diego since completion of the citywide Climate Change Hazard Vulnerability Assessment in February 2020. This analysis found the Point Loma Wastewater Treatment Plant to be highly vulnerable to coastal erosion. Please see Point Loma Wastewater Treatment Plant Coastal Erosion Assessment and Recommendation (January 2021), and Climate Change Action Plan, Special Studies Requirement VI of Order No. R9-2017-0007 (September 2020).

ⁱCrockett, J. L. & Westerling, A. L. (2018). Greater Temperature and Precipitation Extremes Intensify Western U.S. Droughts, Wildfire Severity, and Sierra Nevada Tree Mortality. *Journal of Climate*, 31(1), 341-354. <https://journals.ametsoc.org/view/journals/clim/31/1/jcli-d-17-0254.1.xml>

ⁱⁱYoon, J.-H., Wang, S.-Y. S., Gillies, R. R., Hipps, L., Kravitz, B., and Rasch, P. J. (2015). Extreme Fire Season in California: A Glimpse into the Future? In: Explaining Extreme Events of 2014 from a Climate Perspective. Special Supplement to the Bulletin of the American Meteorological Society, 96(12). <https://journals.ametsoc.org/view/journals/bams/96/12/bams-explainingextremeevents2014.1.xml>

ⁱⁱⁱPrein, A. F., Holland, G. J., Rasmussen, R. M., Clark, M. P., and Tye, M. R. (2016). Running dry: The U.S. Southwest's drift into a drier climate state. *Geophys. Res. Lett.*, 43, 1272-1279. doi:10.1002/2015GL066727. <https://agupubs.onlinelibrary.wiley.com/doi/10.1002/2015GL066727>

^{iv}US Forest Service. (2016). Forest Service Survey Finds Record 66 Million Dead Trees in Southern Sierra Nevada. <https://www.fs.usda.gov/news/releases/forest-service-survey-finds-record-66-million-dead-trees-southern-sierra-nevada>

^vWesterling, A. L., Hidalgo, H. G., Cayan, D. R., and Swetnam, T. W. (2006). Warming and earlier spring increase western U.S. forest wildfire activity. *Science*, 313(5789), 940-943. <https://www.science.org/doi/10.1126/science.1128834>

^{vi}Chmura, D. J., Anderson, P. D., Howe, G. T., Harrington, C. A., Halofsky, J. A., Peterson, D. L., Shaw, D. C., and St. Clair, J. B. (2011). Forest responses to climate change in the northwestern United States: Ecophysiological foundations for adaptive management. *Forest Ecology and Management*, 261(7), 1121-1142. <https://www.sciencedirect.com/science/article/abs/pii/S0378112711000028>

^{vii}Liu, Y., Stanturf, J., and Goodrick, S. (2010). Trends in global wildfire potential in a changing climate. *Forest Ecology and Management*, 259(4), 685-697; and Westerling, A. L., Hidalgo, H. G., Cayan, D. R., and Swetnam, T. W. (2006). Warming and earlier spring increase western U.S. forest wildfire activity. *Science*, 313(5789), 940-943. <https://www.sciencedirect.com/science/article/abs/pii/S0378112709006148> and <https://www.science.org/doi/10.1126/science.1128834>

^{viii}Kalansky, J., Cayan, D., Barba, K., Walsh, L., Brouwer, K., Boudreau, D. (University of California, San Diego). 2018. San Diego Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCCA4-2018-009. https://www.energy.ca.gov/sites/default/files/2019-11/Report-SUM-CCCA4-2018-009_SanDiego_ADA.pdf

^{ix}Steinberg, Nik, Emilie Mazzacurati, Josh Turner, Colin Gannon, Robert Dickinson, Mark Snyder, Bridget Thrasher. (Four Twenty Seven and Argos Analytics). 2018. Preparing Public Health Officials for Climate Change: A Decision Support Tool. California's Fourth Climate Change Assessment, California

Natural Resources Agency. Publication number: CCCA4-CNRA-2018-012. https://www.energy.ca.gov/sites/default/files/2019-12/PublicHealth_CCCA4-CNRA-2018-012_ada.pdf

^xFour climate models were used for this analysis (HadGEM2-ES, CNRM-CM5, CanESM2, and MIROC5), all of which have been selected by California state agencies as priority models for research contributing to California's Fourth Climate Change Assessment.

^{xi}Kalansky, J., Cayan, D., Barba, K., Walsh, L., Brouwer, K., Boudreau, D. (University of California, San Diego). 2018. San Diego Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCCA4-2018-009. https://www.energy.ca.gov/sites/default/files/2019-12/PublicHealth_CCCA4-CNRA-2018-012_ada.pdf

^{xii}Messner, S., Miranda, S., Green, K., Phillips, C., Dudley, J., Cayan, D., Young, E. (2011). Climate Change-related Impacts in the San Diego Region by 2050. CEC-500-2009-027-F. https://www.researchgate.net/publication/227583843_Climate_change-related_impacts_in_the_San_Diego_region_by_2050

^{xiii}NOAA. (2018). Relative Sea Level Trend 9140170 San Diego, California. NOAA Tides & Currents. https://tidesandcurrents.noaa.gov/slrends/slrends_station.shtml?id=9410170

^{xiv}IPCC. (2013). Climate Change 2013: The Physical Science Basis. Cambridge University Press. Cambridge, MA. <http://www.ipcc.ch/report/ar5/wg1/>

^{xv}Over the past century, mean global sea level has risen approximately 1.7 mm per year (about 0.07 inches per year) accelerating to a rate of 3.2 mm per year since 1993 (IPCC 2013). From 1906 to 2017, the tide gage at San Diego suggests a rise of approximately 2.17 mm per year (about 0.09 inches per year), approximately 32% higher than the global rate. NOAA. (2018). Relative Sea Level Trend 9140170 San Diego, California. NOAA Tides & Currents. https://tidesandcurrents.noaa.gov/slrends/slrends_station.shtml?id=9410170

^{xvi}California Coastal Commission. (2018). California Coastal Commission Sea Level Rise Policy Guidance: Interpretive Guidelines for Addressing Sea Level Rise in Local Coastal Programs and Coastal Development Permits. https://documents.coastal.ca.gov/assets/slris/guidance/2018/0_Full_2018AdoptedSLRGuidanceUpdate.pdf

^{xvii}OPR. (2017). Rising Seas in California: An Update on Sea Level Rise Science. <https://opr.ca.gov/meetings/tac/2017-06-16/docs/rising-seas-in-california-an-update-on-sea-level-rise-science.pdf>

^{xviii}Buchanan, M. K., Oppenheimer, M., & Kopp, R. E. (2017). Amplification of flood frequencies with local sea level rise and emerging flood regimes. *Environmental Research Letters*, 12(6), 064009. <https://iopscience.iop.org/article/10.1088/1748-9326/aa6cb3>

^{xix}Young, A. P. (2018). Decadal-scale coastal cliff retreat in southern and central California. *Geomorphology*, 300, 164-

175. <https://www.sciencedirect.com/science/article/abs/pii/S0169555X17304476>

xx SANDAG. (2001). 2001 Regional Beach Sand Project. https://www.sandag.org/index.asp?projectid=101&fuseaction=projects_detail

xxi Vitousek, S., Barnard, P. L., Limber, P., Erikson, L., and Cole, B. (2017). A model integrating longshore and cross-shore processes for predicting long-term shoreline response to climate change. *Journal of Geophysical Research Earth Surface*, 122(4), 782-806. <https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1002/2016JF004065>

xxii Western Regional Climate Center. (2018). SAN DIEGO LINDBERGH FLD, CALIFORNIA (047740): Period of Record Monthly Climate Summary. <https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7740>

xxiii Seager, R., Hoerling, M., Schubert, S., Wang, H., Lyon, B., Kumar, A., and Henderson, N. (2015). Causes of the 2011–14 California drought. *Journal of Climate*, 28(18), 6997–7024. <https://journals.ametsoc.org/view/journals/clim/28/18/jcli-d-14-00860.1.xml>

xxiv Swain, D. L., Langenbrunner, B., Neelin, J. D., & Hall, A. (2018). Increasing precipitation volatility in twenty-first-century California. *Nature Climate Change*, 1. <https://www.nature.com/articles/s41558-018-0140-y>

xxv Ibid. <https://www.nature.com/articles/s41558-018-0140-y>

xxvi EPA. 2021. Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. U.S Environmental Protection Agency, EPA 430-R-21-003. https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf





4.0 How We Will Thrive

Connected & Informed Communities

Resilient & Equitable City

Historic & Tribal Cultural Resources

Thriving Natural Environments

Critical City Services

Implementation Framework



How We Will Thrive

Climate change is already impacting San Diegans; we experience wildfires, heat waves and flooded streets. These climate change related events will continue and intensify in the coming years. By taking action now and planning for a resilient San Diego, we can reduce risk and enhance our climate change readiness. As we plan for the effects of climate change, the City will ensure that communities are connected and informed

about how climate change will impact their daily lives. Decisions must be inclusive, equitable and based on the best available science. Historic and tribal cultural resources need to be protected, and natural environments should be conserved and enhanced. Critical City services must also be maintained to protect public health and safety and support our daily activities.



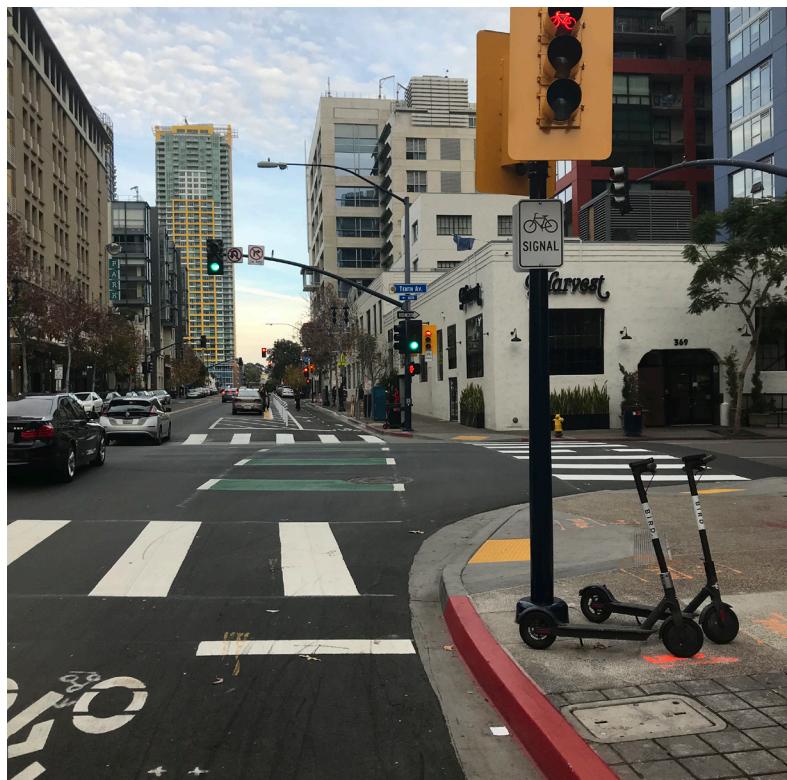
CLIMATE RESILIENT SD HAS FIVE MAIN GOALS

- 1 Ensure communities are connected and informed to be best prepared for climate change**
- 2 Plan for and build a resilient and equitable city**
- 3 Safeguard, preserve and protect historic and tribal cultural resources from the effects of climate change**
- 4 Support and prioritize thriving natural environments and enhance adaptability**
- 5 Maintain and ensure minimal disruption to all critical City services in the face of climate change hazards**

The goals reflect the broader vision for San Diego as we plan for a changing climate and what a resilient San Diego should look like. Each goal includes supporting policies that reflect our values and priorities and help guide the implementation of the adaptation and resilience strategies. The adaptation and resilience strategies are a suite of actions that will bring us closer to making these five goals a reality. These strategies support and expand upon existing efforts already undertaken by the City to prepare for a changing climate, such as wildfire preparedness, increasing urban tree canopy and increasing our protected habitat areas. The adaptation and resilience strategies will build a more climate ready San Diego, improving our ability to not just bounce back from climate change events, such as heat waves or wildfire, but to bounce forward, to a greener, more equitable and thriving future.

Successful implementation of these strategies will require continued community involvement, working closely with community members to identify community needs and opportunities, especially in our underserved communities.

Successful implementation will also leverage the additional benefits provided by many of these strategies. These additional benefits - or core benefits - are services and benefits provided by adaptation strategies beyond risk mitigation. For example, increasing green spaces in areas subject to flooding helps to lower the risk of flooding, but also improves air quality, provides recreational opportunities and provides additional habitat for plants and animals. Adaptation strategies that have core benefits can be inherently better for communities and for the City overall. Along with the effectiveness and cost of strategies, core benefits should be used to prioritize strategy implementation. More detailed information on each strategy, including its core benefits, cost, implementation timeframe and the climate change hazards it addresses, is contained in Appendix A, Adaptation and Resilience Strategies.



Connected & Informed Communities

Goals:

Ensure communities are connected and informed to be best prepared for climate change.

Coordinate community involvement and participation in quick impact projects to catalyze local engagement.

Community preparedness is critical for protection of physical safety, social cohesion and continued economic vitality. In order for communities to be most prepared for a changing climate, people need to have knowledge of how a climate change hazard might affect their daily life, awareness of resources available to them and ability to access necessary critical services. A more informed community will be better prepared to respond to and recover from climate change events. Further, tighter knit communities with closer social

When participants in the first community workshop were asked, "What solutions would benefit you and your community the most?," two of the top responses were related to education—citing the need for more educational resources on climate change impacts, and climate change education for youth. The City's community based organization partners in this engagement effort also reported similar feedback on the need for more educational information on climate change impacts.

connections between neighbors will be better able to disseminate information, assist each other in accessing resources, and bounce back from climate change impacts. A strong social fabric builds cohesiveness and strength in community response. The City aims to help empower and support community connection building and serve as a resource for information and services.

Climate change hazards do not abide by jurisdictional boundaries. Climate resilience will require collaboration between the City and its regional partners. Through collaborating with other cities and the County, local universities, community groups, non-profits, tribal nations and regional organizations, the City will be able to both contribute to and benefit from regional knowledge and resources. Collaboration, communication and education will be key pillars in achieving local and regional climate resilience.

Policy CI-1: Provide easily accessible education resources and grow community awareness of climate change.



Policy CI-2: Enhance ability of communities to prepare for, respond to and recover from climate change impacts.

Policy CI-3: Strengthen the City's regional partnerships to leverage and expand available resources for climate resilient actions.

Policy CI-4: Collaborate with arts, cultural and creative sector to increase community awareness of and engagement with climate planning.

Policy CI-1: Provide easily accessible education resources and grow community awareness of climate change.

- Develop a comprehensive climate adaptation community outreach program. Conduct community outreach through various methods and in multiple languages to share climate change and climate adaptation information and resources with communities.
- Increase investment in a citywide public outreach and education campaign to increase the public awareness of water quality matters.

Policy CI-2: Enhance ability of communities to prepare for, respond to, and recover from climate change impacts.

- Provide grid resilience services through grid-integrated vehicle programs.
- Develop resilient design guidelines or modify zoning, permitting processes, and standards to support smart, sustainable, resilient development and reduce exposure to climate change hazards.
- Hold community trainings for emergency response and preparedness.
- Expand and amplify wayfinding and public outreach campaigns for wildfire response. Support community preparedness with focused public outreach. Consider needs of those without car access, people experiencing homelessness, and people with disabilities.

Policy CI-3: Strengthen the City's regional partnerships to leverage and expand available resources for climate resilient actions.

- Coordinate with local transit agencies for resilient public transit systems upgrades.
- Collaborate with climate science experts on local climate change impacts, mitigation and adaptation to inform public policy decisions.
- Build regional resilience through collaboration with local, regional and State agencies as well as local tribal nations, inter-tribal organizations, community based organizations and nonprofits.



Policy CI-4: Collaborate with arts, cultural and creative sector to increase community awareness of and engagement with climate planning.

- Explore varied approaches and platforms to engage people in discourse, learning and actions around climate change and the environment.
- Develop a cultural plan that connects arts and culture with City sustainability and resiliency goals.



Resilient & Equitable City

Goal: Plan for and build a resilient and equitable City.

To build a truly resilient San Diego, existing inequities must be addressed, and an equitable plan for prioritizing investments must be developed. Integrating social equity across City operations, centering racial and social justice practices in outreach and strengthening community partnerships are critical to achieving these goals. The impacts of climate change will not be felt equally by all communities, as some are more vulnerable than others. Historic disinvestments and unjust systems have resulted in some communities having access to fewer resources and being disproportionately impacted by climate change. These communities will face greater exposure to climate change hazards and experience climate change related impacts first and worst. By supporting and uplifting the most vulnerable populations and ensuring that they are

safe and healthy despite potential climate change impacts, we can build a stronger, more resilient and equitable City.

Through the development of the City's Climate Equity Index (see Figure 11), communities most vulnerable to climate change have been identified. The Climate Equity Index measures the level of access to opportunity that residents have and assesses the degree of potential impact climate change may have on these areas. Thirty-five indicators, such as asthma rates, healthy food access, tree coverage and median income, were identified to assess access to opportunity. Census tracts with a score of very low, low, or moderate access to opportunity are referred to as Communities of Concern. Because the needs are greater in Communities of Concern, implementing climate adaptation and resilience strategies should be prioritized in these communities. In addition to other factors, resiliency strategies have been identified that deliver direct benefits, generate multiple benefits and build capacity within these communities.

Policy RE-1: Prioritize resilience investments and implementation of strategies in Communities of Concern, as identified in the Climate Equity Index.

Policy RE-2: Foster vibrant, healthy and sustainable communities.

Policy RE-3: Prioritize strategies with multiple benefits that increase the adaptive capacity of the City's most vulnerable communities.

Policy RE-4: Deepen community partnerships to support greater community involvement in resilience action and plan implementation.

Policy RE-5: Ensure vulnerable communities have resources necessary to respond to climate change impacts.



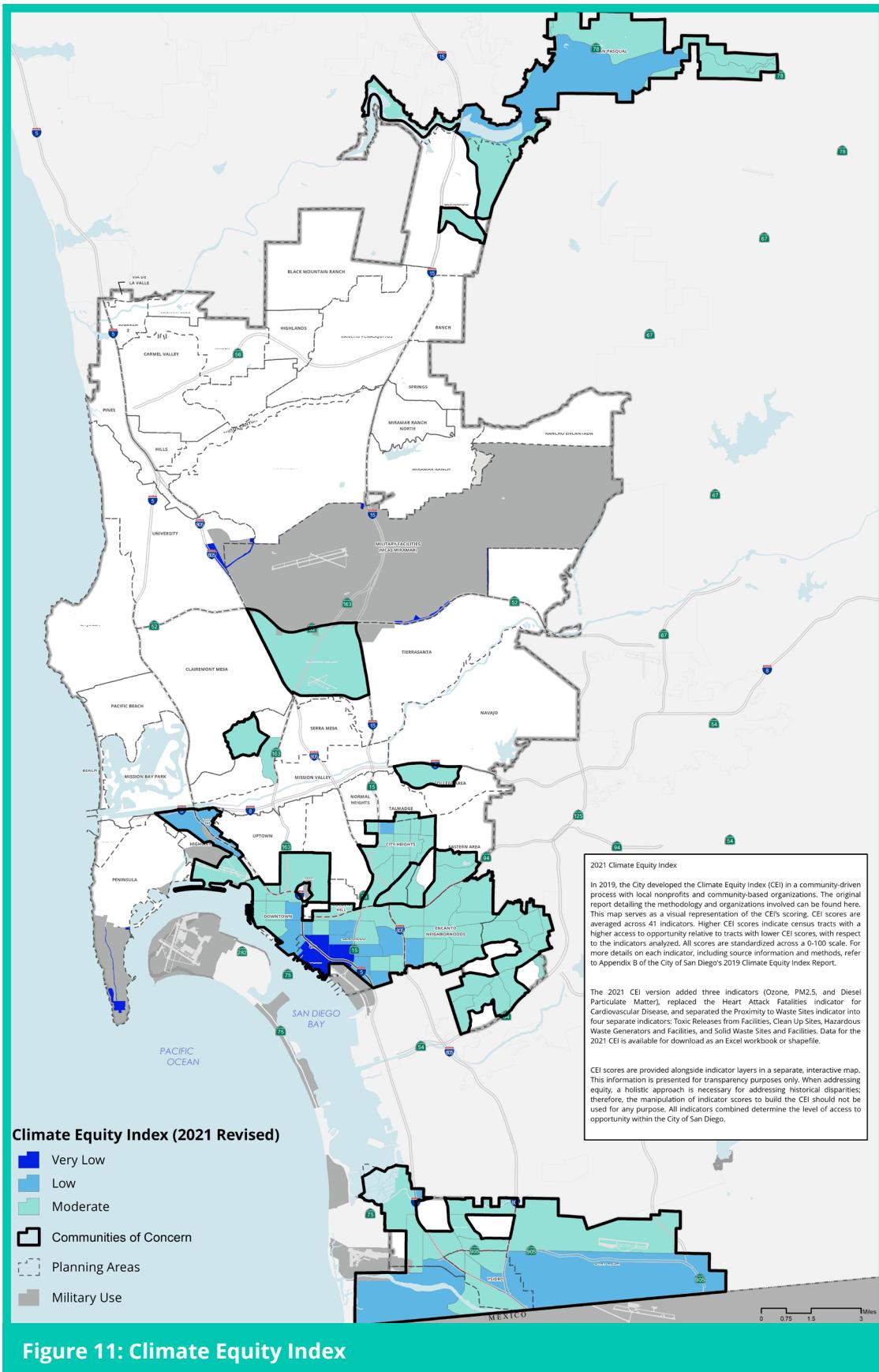


Figure 11: Climate Equity Index

Policy RE-1: Prioritize resilience investments and implementation of strategies in Communities of Concern, as identified in the Climate Equity Index.

- Utilize Climate Equity Fund and other funding sources to direct investments to resilience projects in Communities of Concern.
- Ensure Capital Improvement Program integrates climate resilience and equity considerations into the budgeting and project selection process.
- Work with Office of Race and Equity to ensure need and priorities of residents in Communities of Concern are reflected in plan implementation.

Policy RE-2: Foster vibrant, healthy and sustainable communities.

- Support expansion and management of an active transportation network. Provide safe, accessible active transportation infrastructure.
- Explore opportunities and programs to increase access to healthy food markets, farmer's markets and other local food networks, particularly for low-income residents and families.



Example of Moss Stop. Green bus stops can make public transit systems more climate ready, helping to reduce urban heat, improve air quality, and absorb rainwater.

Photo source: Clear Channel UK



- Increase access to parks and open space for all San Diegans. Increase overall shaded area at park spaces. Natural shade from trees shall be prioritized over artificial shade structures, whenever feasible.
- Incentivize installation of cool roofs and green roofs.
- Utilize the Urban Heat Vulnerability Index to help inform implementation of adaptation strategies to address extreme heat events and identify priority areas for cooling interventions.

Policy RE-3: Prioritize strategies with multiple benefits that increase the adaptive capacity of the City's most vulnerable communities.

- Collaborate with the Air Pollution Control District (APCD) to implement the Community Emissions Reduction Plan (CERP) and AB 617.
- Develop an urban greening program to promote expanded green spaces in urban areas. The program should facilitate greening of City buildings and encourage private development to include green features through policy development or incentive programs.
- Establish a community garden program to convert vacant lots, rooftops or other available space to public community gardens.

Policy RE-4: Deepen community partnerships to support greater community involvement in resilience action and plan implementation.

- Cultivate leadership and environmental stewardship in San Diego's youth. Consider partnerships with local schools and universities, and tribal organizations with active climate and resiliency programs, as well as focused internship programs and leadership opportunities.
- Create principles for meaningful, equitable community engagement. Identify ways to remove barriers to participation.
- Promote water conservation, water reuse and best management practices in local businesses and industry.

Policy RE-5: Ensure vulnerable communities have resources necessary to respond to climate change impacts.

- Support community centered resilience action. Partner with community based organizations to promote preparedness and response actions.
- Develop resilience hubs in coordination with County of San Diego Public Health Department and community-based organizations. Resiliency hubs can provide shelter, food distribution, healthcare, or other services as needed. Evaluate feasibility of solar microgrid battery backup implementation.
- Coordinate with the County of San Diego Department of Public Health on Cool Zones program. Provide easily accessible locations, particularly in Communities of Concern. Expand access to Cool Zones, shade corridors and the coast.
- Explore opportunities for neighborhood microgrants to funds community driven projects to enhance community resilience and foster community connections.

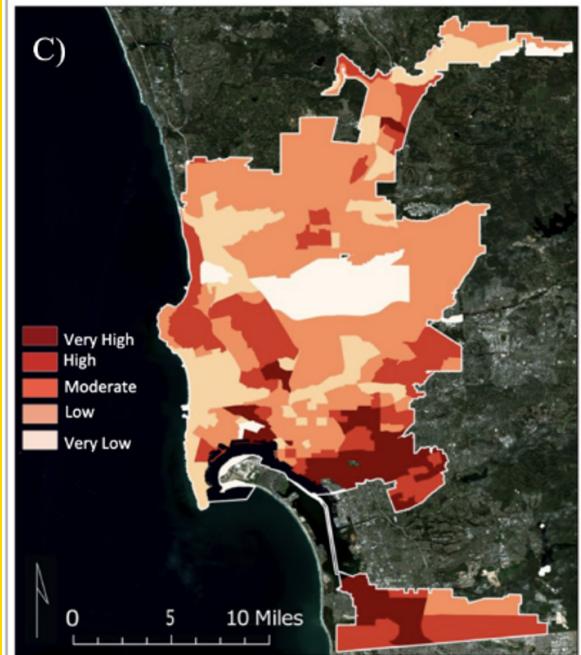
CASE STUDY

Urban Heat Vulnerability Index

Like many urban areas, San Diego is facing the effects of climate change, including an increase in frequency of extreme heat events. Rising temperatures from climate change further exacerbate the urban heat island effect. The urban heat island effect is where urban regions are significantly warmer than surrounding undeveloped areas. Urban heat islands are caused by many factors, such as the amount of paved areas or lack of green space. To better address urban heat, the City of San Diego partnered with NASA DEVELOP¹ to create an Urban Heat Vulnerability Index. The NASA DEVELOP team used satellite imagery to look at heat exposure and best available data to consider heat vulnerability factors, such as age or existing health conditions. Heat exposure and vulnerability were combined to assess overall heat risk. The project also analyzed the cooling capacity of areas based on characteristics of the land, such as land cover or tree canopy cover. This Urban Heat Vulnerability Index is an initial implementation of Climate Resilient SD and can be used to prioritize at-risk communities for the implementation of heat reduction or cooling intervention strategies.

¹ This partnership was funded by the Thriving Earth Exchange.

Heat Risk by Census Tract



Historic & Tribal Cultural Resources

Goal: Safeguard, preserve and protect historic and tribal cultural resources from the effects of climate change.

San Diego is home to many historic and tribal cultural resources, which can take a wide variety of forms. These include buildings, structures, objects, districts, archaeological sites and artifacts, traditional cultural properties and tribal cultural resources, historic documents and historical or cultural landscapes. All are important because they tell the story of our region, from when the ancestors of the Kumeyaay and Luiseño peoples first inhabited this area thousands of years ago, up to the present day.

In the City's Climate Change Vulnerability Assessment, historic and tribal cultural resources were found to be highly vulnerable to all climate change hazards except heat. These assets could suffer severe damage, are irreplaceable when

destroyed, and their historic and tribal cultural nature requires more thought, consideration, and oversight when implementing protective measures. As the loss or damage of these resources could result in the permanent loss of historic and tribal cultural resources that may be integral to the identity of San Diego, it is critical that we implement policies and adaptation strategies that can help protect them.

Policy HTC-1: Preserve and protect historic and tribal cultural resources against climate change impacts.

Policy HTC-2: Foster partnerships and collaboration opportunities with tribal liaisons and partners.

Policy HTC-3: Honor and share traditional knowledge of land management and cultural significance.

Policy HTC-4: Incorporate climate change considerations into historic and tribal cultural planning and stewardship.



Policy HTC-1: Preserve and protect historic and tribal cultural resources against climate change impacts.

- Practice proactive and robust decision-making for cultural resources. Use modeling and scenario planning to understand likely future impacts of climate change on individual resources; identify intervention options available to mitigate impacts; and implement the intervention measures in a timely manner to maximize preservation efforts.
- Consider historic properties of religious and cultural significance to local tribes during consultation to develop appropriate avoidance measures and/or project redesign opportunities to protect resources.

Policy HTC-2: Foster partnerships and collaboration opportunities with tribal liaisons and partners.

- Coordinate resilience planning with tribal groups and representatives through government-to-government consultation. Foster greater collaboration with representatives of local tribal nations and/or intertribal organizations with traditional

knowledge of native species diversity and ecological processes and patterns that honors historical knowledge of tribal natural resource management, adaptive management, and resource protection.

Policy HTC-3: Honor and share traditional knowledge of land management and cultural significance.

- Research, write and share climate stories, particularly related to historic and tribal cultural resources.
- Incorporate Indigenous Knowledge/Traditional Ecological Knowledge (IK/TEK) into the preservation and protection of historic and tribal cultural resources.

Policy HTC-4: Incorporate climate change considerations into historic and tribal cultural planning and stewardship.

- Incorporate climate change impacts to historic and tribal cultural resources planning. Develop and implement a cultural resources management plan that aims to reduce stress and minimize exposure of historic, archaeological and tribal cultural resources to climate change impacts.



Thriving Natural Environments

Goal: Support and prioritize thriving natural environments and enhance adaptability.

The City's natural and open spaces provide a multitude of benefits to the region and its residents. Open spaces and parks provide opportunity for active recreation, sports and community gathering. Natural spaces provide critical habitats for endangered species and other wildlife. These spaces also provide valuable resilience benefits and services, such as cleaner air, flood water management and cooler neighborhoods. The protection of our existing natural spaces and expansion of green spaces in our communities will provide social, economic and environmental benefits while better preparing our City for a changing climate.

Policy TNE-1: Protect environmental quality and biodiversity.

Policy TNE-2: Protect and improve the integrity of open space, habitat and parks.

Policy TNE-3: Prioritize the implementation of nature-based climate change solutions wherever feasible.

Policy TNE-4: Prioritize installation of green infrastructure wherever feasible.

Policy TNE-5: Manage the coastline as a social, economic and environmental resource for current and future generations.

Policy TNE-6: Protect and expand the City's urban forest.



A NATURE-BASED SOLUTIONS APPROACH

Nature-based solutions are projects to protect, sustainably manage and restore natural or modified ecosystems, while also addressing societal challenges, improving human well-being and providing biodiversity benefits. A nature-based solutions approach can help the City protect against climate change risks, such as heatwaves, storms and coastal flooding. For example, nature-based projects, such as an expansion of the urban tree canopy, can provide neighborhood cooling on hot days, improve air quality and public health, help absorb rainwater and reduce local flooding, and improve the enjoyability of shared community space. Nature-based solutions also support economic vitality, ensuring that open spaces, beaches, parks and local landmarks are available for recreation and tourism while also encouraging innovation and helping to stimulate the economy with new green jobs. In addition to providing social, economic and environmental benefits, nature-based solutions typically are lower cost over the project lifespan.

💡 While multiple solutions can provide protection against the impact of waves, nature-based solutions like wetland restoration can be more cost effective over time, while also providing education opportunities and critical habitat for many plants and animals.

Success of nature-based solutions depend on healthy ecosystems. A nature-based solutions approach should utilize native plant species wherever feasible and consider future conditions during planning efforts as many ecosystems may be vulnerable to changing climate conditions. Impacted or damaged ecosystems will have reduced ability to mitigate risk from climate change and to provide the additional benefits associated.

NATURE-BASED SOLUTIONS & OUR COAST

The coast is a natural resource that provides a multitude of benefits to San Diego. A hotspot for biodiversity, the coast is a critical environmental resource. A diverse range of marine life and habitat can be found here, including such iconic species as harbor seals, dolphins, whales and leopard sharks. The coast is also an economic resource, drawing visitors to the region and supporting the tourism industry. Locally, the coast supports many businesses whose customers seek the view of the ocean or the ability to cool off during hot days by the beach. San Diego's beaches and bays also offer incredible recreation value, providing the opportunity to swim, kayak, paddle, surf, boat, camp, jog, play volleyball, birdwatch, or simply just relax and enjoy the scenic beauty. The City of San Diego recognizes the great value of the coast, as an economic, environmental and recreational asset for the region. Planning efforts will continue to manage the coastline to ensure that these benefits are available to all San Diegans, now and into the future.

Policy TNE-1: Protect environmental quality and biodiversity.

- Develop an ecosystem fire recovery plan to address revegetation and post-fire treatments for open space and community parks if affected by wildfire. The ecosystem fire recovery plan will outline implementation actions for post-fire treatments to protect and improve ecosystem health.
- Develop an action plan to support the completion of the City's Multiple Species Conservation Plan Preserve.

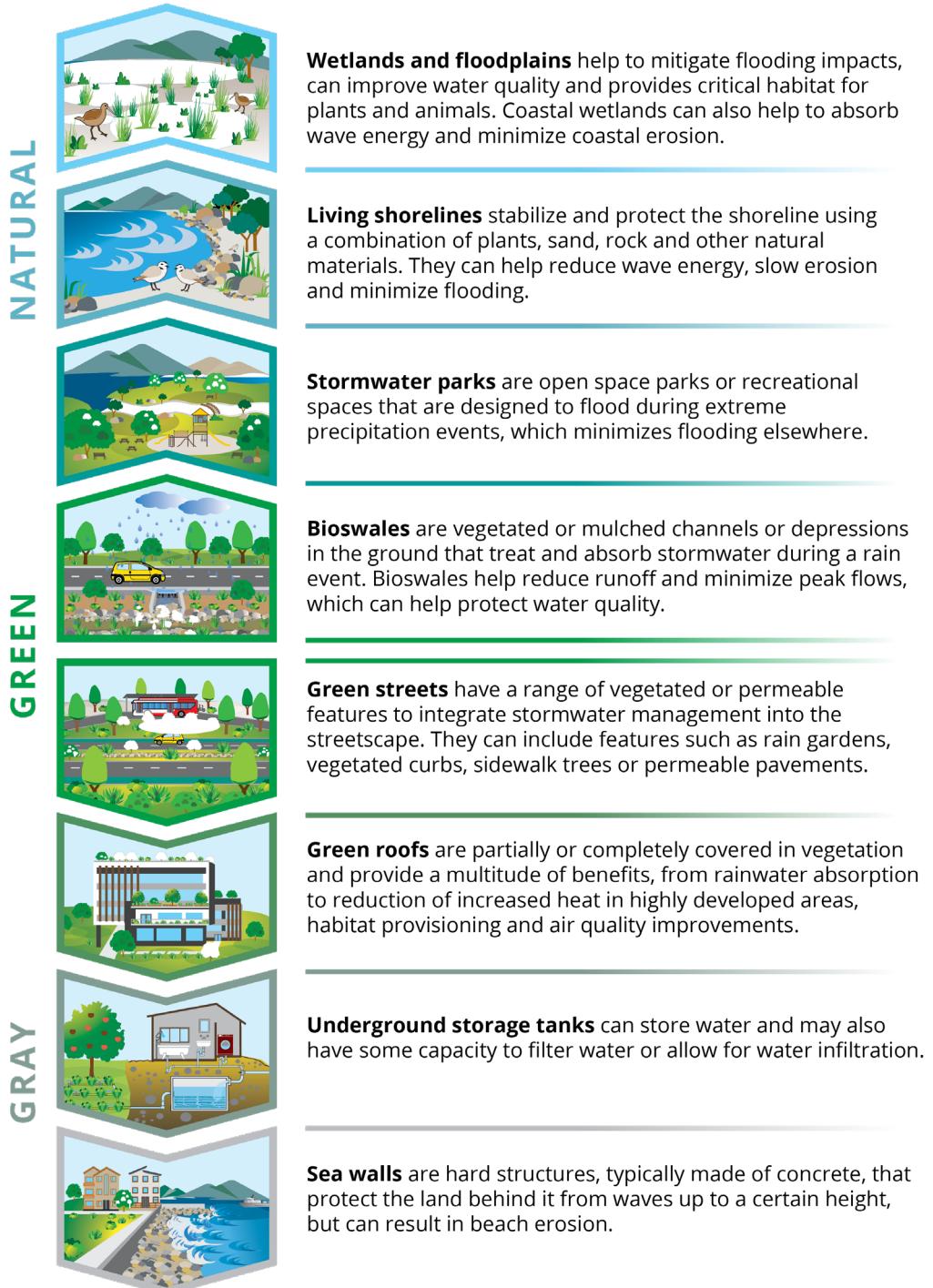


- Continue to implement land management practices that support ecosystem function and healthy watersheds and, in turn, increase the capacity of the system to withstand stress due to climate change.
- Protect, restore and enhance urban canyons. Support habitat restoration of urban canyons with native plant species, inclusion of environmental education and recreation opportunities and continued preservation.

NATURE-BASED SOLUTIONS

The term “nature-based solutions” encompasses **natural infrastructure**, which includes existing or restored natural landscapes, such as wetlands, forests or open space and **green infrastructure**, which includes a wide range of built or engineered solutions modeled after nature to support purposes such as stormwater management, flooding, urban heat island and climate adaptation.

Gray infrastructure, on the other hand, refers to hard, man-made structures that are engineered for a specific level of service given certain conditions. The following graphic compares several types of nature-based solutions and gray infrastructure that can help address flooding.



Policy TNE-2: Protect and improve the integrity of open space, habitat and parks.

- Prioritize the preservation, restoration and expansion of natural features such as habitat, open space, wetlands, kelp forests, marshes and vegetated buffers to increase resilience of natural systems. Continue to implement and uphold the Multiple Species Conservation Program to preserve network of habitat and open space and to protect biodiversity.
- As identified in the Parks Master Plan, complete a Trails Master Plan. The Trails Master Plan should account for climate change impacts, such as increased erosion due to precipitation or sea level rise.
- Conduct regular brush management in high wildfire risk zones.
- Complete inventory of open space and community park plans to identify needs as related to climate change impacts.
- Update open space and community park plans as needed, including master plans, precise plans, general development plans and natural resource management plans to protect open space and park land against impacts of climate change and to improve natural integrity.

Policy TNE-3: Prioritize the implementation of nature-based climate change solutions wherever feasible.

- Implement nature-based shoreline protection methods to protect areas subject to coastal flooding. Develop a coastal resilience master plan that would identify locations for implementation of nature-based solutions to mitigate coastal flooding and erosion, improve coastal resiliency, protect habitat and increase recreational opportunities for residents and visitors.

In the adaptation strategies survey, 89% of participants preferred soft or nature-based solutions to hard or traditional engineering solutions.

Policy TNE-4: Prioritize installation of green infrastructure wherever feasible.

- Improve stormwater infrastructure resilience.
- Maximize planning and implementation of green infrastructure at watershed scale and site specific.

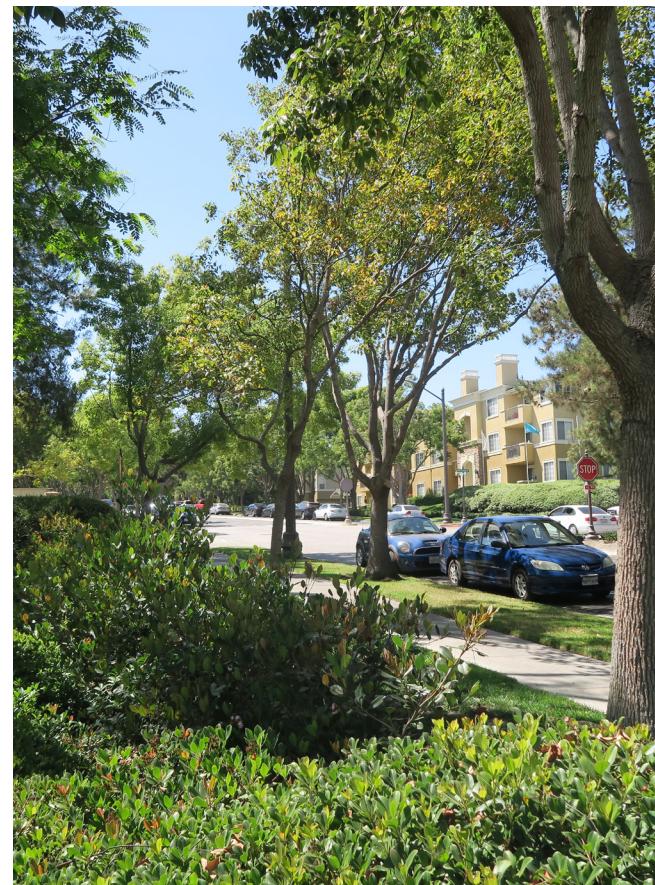


Policy TNE-5: Manage the coastline as a social, economic and environmental resource for current and future generations.

- Update the City's Local Coastal Program.
- For City-owned properties and leaseholds, consider rolling easements to establish a development boundary that moves inward as sea level rises along the shoreline.
- Update the Coastal Erosion Assessment regularly to identify current conditions of coastline bluffs, beaches, access stairs, ramps, outfalls, seawalls or other related infrastructure.
- Utilize adaptive pathways for coastline planning.

ⓘ WHAT ARE ADAPTIVE PATHWAYS?

Adaptive pathways is a planning framework that considers the uncertainty of climate change, the change in risk conditions and allows for flexibility in implementation to improve effectiveness and economic efficiency. An adaptive pathways approach identifies thresholds or points in time when decisions or action pathways should be revisited, allowing for adjustments in implementation to be made based off of changing conditions.



In the adaptation strategies survey, 93% of participants wanted to see more trees and green spaces in their neighborhood. Tree canopy cover, green roofs and cool roofs were the preferred strategies to address heat and improve air quality.

Policy TNE-6: Protect and expand the City's urban forest.

- Maintain and expand the City's urban tree canopy to meet the City's Climate Action Plan goals.
- Incorporate considerations for a changing climate into urban forestry management and planning. Update the Urban Forestry Program 5 Year Plan with consideration for tree species diversification, salt tolerance, and irrigation needs.

ⓘ Tourism is San Diego's second largest industry, employing 194,000 people across the county and generating \$940 million for the local economy (San Diego Tourism Authority, 2018). Protecting our natural spaces and recreation opportunities that draw people to visit San Diego will help protect San Diego's economy and quality of life for years to come.

Critical City Services

Goal: Maintain and ensure minimal disruption to all critical City services in the face of climate change hazards.

The City has completed a Climate Change Vulnerability Assessment in order to understand how climate change-related hazards could affect assets and services owned and managed by the City. The vulnerability assessment found that many critical City assets and services may be vulnerable to climate change related hazards in the future. All of the hazards investigated—wildfire, extreme heat, flooding and drought and sea level rise—pose potential risks to City assets and services.

Damage, disruption or failure of some of these City assets could have major consequences and impede the ability of the City to continue its services and protect public health and safety. Exposure to climate change related hazards could result in consequences such as delays in emergency response; impacts to City facilities; damage to historical, tribal cultural, or archaeological resources; or impacts to protected habitats/species. Implementing potential policies and adaptation strategies that will allow the City to maintain its assets and continue its services with minimal disruption is a key priority.



Policy CCS-1: Protect public health and safety.

Policy CCS-2: Secure and maintain water and wastewater supplies and services.

Policy CCS-3: Improve ability of infrastructure and built systems to withstand climate change shocks and stressors, while maintaining provision of essential services.

Policy CCS-4: Build City capacity to be responsive to future climate change related events and challenges.

Policy CCS-5: Consider cost, effectiveness, lifespan and core benefits for adaptation strategy prioritization and implementation.

Policy CCS-6: Prepare City for upcoming funding opportunities from State, Federal and grant programs to ensure City is competitive to secure funding.



Policy CCS-1: Protect public health and safety.

- Identify critical transportation network elements and create emergency transportation alternatives and detours for vulnerable routes. Prioritize corridors that act as evacuation routes or provide access to critical facilities.
- Develop a flood assistance program.
- Establish levees inspection and maintenance program to ensure the levee system continues to provide an adequate flood protection. Update the Levee System Operation and Maintenance Manual.

Policy CCS-2: Secure and maintain water and wastewater supplies and services.

- Continue to update the Urban Water Management Plan every five years to reexamine future vulnerabilities to the City water supply.
- Continue efforts to diversify the City's water supply sources and reduce dependence on imported water.
- Promote stormwater as a resource concept by implementing capture and reuse technologies where feasible.
- Replace or rehabilitate water and wastewater pipes to maintain a state of good repair, minimize breaks and ensure structural integrity in the face of climate change hazards such as flooding.
- As Water Design Guidelines and Sewer Design Guidelines are updated, consider climate change impacts, such as sea level rise, coastal erosion and changes in precipitation.
- Account for projected changes in precipitation and sea level rise in water and wastewater planning.
- Prepare and implement a facility climate

CASE STUDY



City of San Diego Pure Water

The City of San Diego relies on importing 85% of its water supply from the Colorado River and Northern California Bay Delta. Limited control over its water supply increased the City's vulnerability to droughts, climate change and natural disasters. The Pure Water Program will reduce vulnerability and increase resiliency of the City's water supply by providing almost half of the City's water needs by 2035. The Pure Water Program uses proven technology to clean recycled water to produce high-quality drinking water.

Photo provided by Public Utilities Department. More than 50,000 lab tests have been conducted to ensure the water produced at the Pure Water Demonstration Facility is safe to add to San Diego's drinking water supply. As part of the City's Pure Water outreach program, nearly 19,000 people have toured the one million gallon-per-day Demonstration Facility since it came online in June 2011.

change action plan for Point Loma Wastewater Treatment Plant.

- Continue efforts to increase wastewater diversion to further reduce likelihood of sanitary sewer overflow.
- Conduct detailed site assessments at active, identified vulnerable waste and wastewater facilities and identify climate change hazard risk mitigation options.
- Integrate projected increases in wildfire frequency and intensity into watershed management and planning, dam and

raw water reservoir operations and dam emergency planning, in alignment with City's Climate Action Plan.

- Promote water conservation through updates to the City irrigation system.

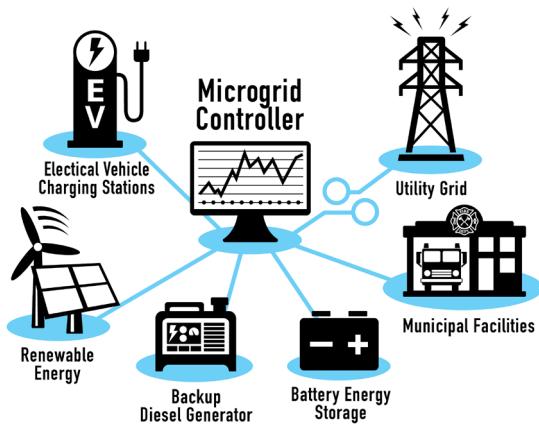
Policy CCS-3: Improve ability of infrastructure and built systems to withstand climate change shocks and stressors, while maintaining provision of essential services.

- Provide cooling systems for City assets and equipment sensitive to overheating.
- Plan for a climate ready transportation network.
- Identify and implement flood protection measures for critical infrastructure.
- Protect mechanical, electrical and other key operational equipment from flooding at critical facilities through facility improvements or adaptive action.
- Conduct site assessments at City facilities and ensure effective management of vegetation, defensible space and hardening of assets as feasible for wildfire preparedness.

Policy CCS-4: Build City capacity to be responsive to future climate change related events and challenges.

- Develop workforce preparedness training opportunities and programs to quickly restore essential City services.
- Build redundancy and/or backup resources available to support critical operations and services during an emergency event.
- Implement a knowledge transfer and training program to ensure that natural hazard response procedures are not lost with staff turnover.

- Create a web map for primary climate change hazard impacts. Update City's geographic information system database as best available science for climate change projections and State guidance is updated.
- Account for high heat days when planning City staff duties to minimize exposure to extreme heat and/or provide necessary protective measures.
- Consider the value of combining renewable generation with battery energy storage systems and/or microgrid installations to increase resiliency in the face of climate change driven energy disruptions, reduce energy costs and support a stable electric grid.



Sustainability Microgrids

Microgrids are standalone power grids that allow a building or set of connected buildings to isolate from the grid and continue to operate during power outages. Renewable microgrids use only renewable energy created and stored onsite to continue to operate during power outages. Smart microgrids allow a building's energy use to dynamically shift to when utility prices are low, resulting in decreased energy operating costs. The City is exploring the use of microgrids to increase the resiliency of its electrical infrastructure, decrease energy costs, and reduce greenhouse gas emissions.



- Implement resilient redesign or identify less intensive land uses for City owned property exposed to flooding.
- Establish a Chief Resilience Officer.
- Identify City buildings appropriate for installation of distributed energy resources like battery energy storage and microgrids to increase City capacity to respond to climate change driven energy disruption and reduce energy costs.
- Explore siting renewable generation projects on City owned land, landfills, lakes and reservoirs.

Policy CCS-5: Consider cost, effectiveness, lifespan, and core benefits for adaptation strategy prioritization and implementation.

- Create City tracking system to monitor the cost of climate change hazard impacts and response.
- Develop a post-hazard tracking system to collect post-event cost data for events that are both above and below the national hazard declaration threshold. Track in a shared asset management database for climate change hazard related cost impacts.
- Develop guidance for capital planning, including resilient design standards for City infrastructure upgrades that consider climate change projections.

Policy CCS-6: Prepare City for upcoming funding opportunities from State, Federal and grant programs to ensure City is competitive to secure funding.

- Explore proven financing tools and emerging grant opportunities to fund resilience focused projects.
- Integrate climate adaptation, resilience and hazard mitigation into long-range planning documents as well as land use planning, capital and budget plans.
- Form a City department climate adaptation working group to coordinate on climate adaptation implementation efforts.



San Vicente Energy Storage Facility

The San Vicente Energy Storage Facility is a pumped energy storage project that will provide up to 500 megawatts of renewable energy upon completion. This joint project by the City of San Diego and San Diego County Water Authority received \$18 million from the State to fund initial design, environmental review and the federal licensing process.

Photo: SDFish.com.

Implementation Framework

CONTINUED COMMUNITY INVOLVEMENT

Implementation will prioritize strategies that protect areas in the City that have the greatest needs, benefit the most people and address areas or assets most vulnerable to climate change hazards. Continued equitable public engagement throughout plan implementation will ensure that community voices continue to be heard, that implementation meets needs of communities and will support long term implementation success.

LIVING DOCUMENT

Wildfires, heat, flooding and sea level rise are already impacting the City. Early action will enable the City to take a proactive approach to address climate risks and more effectively leverage resources to build prepared and resilient communities. As the City implements *Climate Resilient SD*, continued effort will be needed to monitor the success and outcomes of adaptation strategies as they are implemented.

As the best available science is updated, new technologies emerge and the understanding of implementation outcomes of adaptation strategies grows, the specific prioritization and selection of adaptation strategies may need to be adjusted. To continue to reflect best available science, community need and implementation outcomes, the *Climate Resilient SD* plan should be updated regularly, at least every 5 years.

ADAPTIVE IMPLEMENTATION

Climate Resilient SD is intended to provide a flexible framework for implementation, consisting of goals, policies and adaptation strategies that address climate change impacts to the City's people, natural resources, infrastructure and

services, with a focus on building stronger, more equitable and more sustainable communities. The strategies are a combination of policies, plans and implementation actions, in alignment with the City's Climate Action Plan, that provide pathways forward to increase the City's capacity to adjust to and prepare for a changing climate. Flexibility in implementation will enable the City to select strategies that will best mitigate risk and build resilience for communities, the environment and the economy.



FUNDING OPPORTUNITIES

To meet the challenge of climate change and to build a more resilient, more equitable city will require significant funding and investment. The level of investment needed cannot be met by existing funding streams alone. New sources of funding will be needed to meet implementation goals. With significant funding anticipated from Federal, State and other granting agencies, the City must be prepared to successfully compete for and secure available funds.

To best position the City to be eligible, ready and competitive for available funding, the City's funding strategy should include alignment of planning efforts, integration of resilience into capital planning, close coordination between departments and consideration of the staff capacity and resources needed for implementation. Building partnerships with community groups and continuing regional collaboration will accelerate San Diego's transition to a climate ready, resilient city.

In addition to continual pursuit of new funding opportunities, the following potential grant funding sources should be pursued wherever feasible:

Potential Federal Grants:

- FEMA Hazard Mitigation Program (HMP)
- FEMA Building Resilient Infrastructure and Communities (BRIC)
- FEMA Flood Mitigation Assistance (FMA)
- NOAA Climate Program Office
- EPA Clean Water State Revolving Fund
- EPA Greening America's Communities / Building Blocks for Communities

Potential State Grants:

- Coastal Conservancy Climate Ready Program
- California Climate Investments (CCI) Urban & Community Forestry Grant Program
- Proposition 1: Integrated Regional Water Management (IRWM) Grant Program
- Department of Water Resources Floodplain Management, Protection, and Risk Awareness Grant Program
- Wildlife Conservation Board Habitat Enhancement and Restoration Program





Appendix A

Adaptation and Resilience
Strategies



Adaptation and Resilience Strategies

How to Read a Strategy:

1. Climate Hazard



Wildfire



Coastal Hazards: coastal flooding and coastal erosion



Extreme Heat



Flooding and Drought

2. Adaptation Strategy

The strategy is a primary action, policy or program to achieve the goals of Climate Resilient SD.

3. Adaptation Strategy Additional Information

Provides additional information, context and/or action items for the adaptation strategy.

4. Implementation Timeframe

Identifies the timeline for the strategy to be implemented. **Near:** Next 5 years; **Mid:** Next 10 years; **Long:** 10 years +; **Ongoing:** Continuous action.

5. Core Benefits

Identifies additional benefits associated with implementation of the adaptation strategy



City Services: maintain critical services provided by the City, such as maintaining streets, water supply, and Fire-Rescue services.



Public Health and Safety: protect members of the public from the effects of extreme heat, flooding, and other climate hazards.



Historic and Tribal Cultural: protect historic and tribal cultural resources such as historic structures, archaeological sites and artifacts and cultural landscapes against the impacts of climate change.



Recreation, Green Spaces & Tourism:

protect the City's recreational spaces, such as parks and beaches, so that residents and visitors alike can continue to enjoy them.



Water Quality & Use: Protect and improve the integrity of our water bodies through stormwater management and promotion of water conservation actions.



Natural Resource Protection and Air Quality Improvement: Protect and improve integrity of the City's natural spaces and resources, providing a multitude of benefits to the City's residents including air quality improvement.



Greenhouse Gas Reductions: Reduce emissions of climate change causing greenhouse gases into the atmosphere.



Economic Continuity: Help the City's economy to continue thriving in the face of climate change impacts.



Social Equity: Protect the City's most vulnerable communities from the effects of climate change.



6. Implementation Cost Estimate

Identifies an order of magnitude cost estimate for implementation of the adaptation strategy. **Low** is up to \$1 million, **Medium** is \$1 million to \$10 million, **High** is exceeding \$10 million.



7. O&M Estimate

Identifies an order of magnitude cost estimate for ongoing operations and maintenance of the adaptation strategy. **Low** is up to \$1 million, **Medium** is \$1 million to \$10 million, **High** is exceeding \$10 million.

1 CLIMATE HAZARDS	2 ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	4 TIMEFRAME	5 CORE BENEFITS	COST CAPITAL / O&M
 3	<p>2 Increase investment in a citywide public outreach and education campaign to increase the public awareness of water quality matters.</p> <p>Increase investment in launching a citywide public outreach and education campaign to educate the general public, businesses and stakeholders on stormwater quality issues. The campaign can include development of educational material, increase in multimedia communication efforts to reach broader audiences, expanded stakeholder engagement, partnerships with private and nonprofit groups and expansion of the rebate program to incentivize residents and businesses to install rain barrels, disconnect downspouts and xeriscaping.</p>	Near to Mid		 6 7



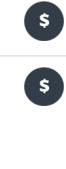
Goal: Ensure communities are connected and informed to be best prepared for climate change.

Policy: CI-1: Provide easily accessible education resources and grow community awareness of climate change.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Develop a comprehensive climate adaptation community outreach program. Conduct community outreach through various methods and in multiple languages to share climate change and climate adaptation information and resources with communities.</p> <p>Create a communication strategy and identify City communication resources to be used to notify the public in advance of, during and after an extreme climate change hazard event.</p> <p>Communicate the impact of climate change hazards to the City and potential adjustments in services with and without adaptation action.</p> <p>Tell the story of the effects of climate change by creating interpretive signage, developing a photo series of changes or other communication methods.</p> <p>Encourage individual resiliency action through educational materials. Implement pilot adaptation projects to inspire and create public awareness.</p> <p>Outreach campaigns could include topics such as water conservation, fire safety or bike safety and cycling education.</p> <p>Provide information and guidance for landowners in areas that are potentially prone to climate change hazards.</p>	Near, Ongoing		
	<p>Increase investment in a citywide public outreach and education campaign to increase the public awareness of water quality matters.</p> <p>Increase investment in launching a citywide public outreach and education campaign to educate the general public, businesses and stakeholders on stormwater quality issues. The campaign can include development of educational material, increase in multimedia communication efforts to reach broader audiences, expanded stakeholder engagement, partnerships with private and nonprofit groups and expansion of the rebate program to incentivize residents and businesses to install rain barrels, disconnect downspouts and xeriscaping.</p>	Near to Mid		

Goal: Ensure communities are connected and informed to be best prepared for climate change.

Policy CI-2: Enhance ability of communities to prepare for, respond to, and recover from climate change impacts.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Provide grid resilience services through grid-integrated vehicle programs.</p> <p>Pilot a variety of grid resilience services, such as demand response, emergency back-up, and demand charge reduction, through three modes of electric vehicle integration: Grid-to-Vehicle, Vehicle-to-Building, and Vehicle-to-Grid.</p>	Near to Mid	 	 
	<p>Develop resilient design guidelines or modify zoning, permitting processes and standards to support smart, sustainable, resilient development and reduce exposure to climate change hazards.</p> <p>Design guidelines should consider future precipitation, sea level rise, wildfire and heat projections. During design phase, plan for climate change projections for lifespan of development and any beneficial resilience retrofits. Resilient design guidelines should protect public health and safety and prioritize inclusion of nature-based solutions.</p> <p>Resilient design guidelines could include:</p> <ul style="list-style-type: none"> a) Guidelines for new development or redevelopments. b) Guidelines for building retrofits. c) Guidelines for design of resilient playgrounds and athletic fields that consider use as temporary flood mitigation areas. d) New "climate resilient" zones, such as coastal resiliency zone or heat resiliency zone. <p>Following completion of the resilient design guidelines , the City's Local Coastal Program should be updated accordingly to reflect new policies and regulations.</p>	Near	 	
	<p>Hold community trainings for emergency response and preparedness.</p> <p>Community trainings can include in-person or online trainings on both personal preparedness and hands on emergency response. Trainings would provide public education opportunity and resources for citizens to learn how to prepare for and respond to events such as wildfires.</p>	Near, Ongoing	 	
	<p>Expand and amplify wayfinding and public outreach campaigns for wildfire response. Support community preparedness with focused public outreach. Consider needs of those without car access, people experiencing homelessness and people with disabilities.</p> <p>Identify and mark emergency routes in the wildland-urban interface in case of evacuations.</p>	Near, Ongoing	 	

Goal: Ensure communities are connected and informed to be best prepared for climate change.

Policy CI-3: Strengthen the City's regional partnerships to leverage and expand available resources for climate resilient actions.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Build regional resilience through collaboration with other local, regional or State agencies, as well as local tribal nations, inter-tribal organizations, community based organizations and nonprofits.</p> <p>Continue regional collaboration with San Diego Associations of Government (SANDAG), the County of San Diego, the Port of San Diego and other local or regional agencies. Build relationships with local community-based organizations. Continue participation in San Diego Regional Climate Collaborative and Adaptation Planning Working Group.</p> <p>Enhance existing City partnerships with appropriate local agencies, community support groups, and service providers to better mitigate hazards that may increasingly result from severe weather and/or climate change.</p>	Near, Ongoing		
	<p>Coordinate with local transit agencies for resilient public transit systems upgrades.</p> <p>Coordinate with Caltrans, MTS and SANDAG for innovative designs for public transit systems, such as "Moss Stops," to support use and comfort of public transit system with future climate conditions.</p> <p>As applicable, consider adding resilient design features to Mobility Choices program to support more widespread implementation.</p>	Near, Ongoing		
	<p>Collaborate with climate science experts on local climate change impacts, mitigation and adaptation to inform public policy decisions.</p> <p>Collaborate with local research institutions and universities for research and monitoring projects to inform implementation of Climate Resilient SD.</p> <p>Coordinate with regional and State agencies and climate science experts on best available science and emerging research.</p>	Near, Ongoing		

Goal: Ensure communities are connected and informed to be best prepared for climate change.

Policy CI-4: Collaborate with arts, cultural and creative sector to increase community awareness of and engagement with climate planning.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Explore varied approaches and platforms to engage people in discourse, learning and actions around climate change and the environment.</p> <p>Arts and culture can be an essential tool for the City in generating creative climate action and environmental engagement. Approaches could range from creative content and awareness building to using artistic practices, creative events and public art interventions to support plan implementation.</p>	Mid	 	 
	<p>Develop a cultural plan that connects arts and culture with City sustainability and resiliency goals.</p> <p>The citywide cultural plan would support sustainability and resiliency objectives and further art and culture infrastructure as an element of community engagement and awareness.</p>	Mid	  	 

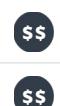
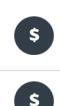
Goal: Plan for and build a resilient and equitable City.

Policy RE-1: Prioritize resilience investments and implementation of strategies in Communities of Concern, as identified in the Climate Equity Index.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Ensure Capital Improvement Program integrates climate resilience and equity considerations into the budgeting and project selection process.</p> <p>Integrate Climate Equity Index, climate change hazard maps and climate projections into capital project planning.</p> <p>Integrate climate resiliency and equity as a prioritization factor.</p> <p>Include climate risks in capital planning and Return on Investment calculations.</p> <p>Consider future Operation and Maintenance and repair costs due to climate change related hazards.</p>	Near, Ongoing		
	<p>Utilize Climate Equity Fund and other funding sources to direct investments to resilience projects in Communities of Concern.</p> <p>Investments should be directed to communities with the greatest need and where the investment can provide the greatest benefit.</p> <p>Utilize Climate Equity Fund as well as other funding sources, such as State and Federal grants, to build community resilience and address existing inequities in infrastructure and community resources.</p>	Near, Ongoing		
	<p>Work with Office of Race and Equity to ensure need and priorities of residents in Communities of Concern are reflected in plan implementation.</p> <p>Collaborate closely with Office of Race and Equity to ensure that people that live in Communities of Concern feel heard and included in implementation.</p>	Near, Ongoing		

Goal: Plan for and build a resilient and equitable City.

Policy RE-2: Foster vibrant, healthy and sustainable communities.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Support expansion and management of active transportation network. Provide safe, accessible active transportation infrastructure.</p> <p>Expand active transportation network, including sidewalks, bike lanes and public transit facilities, to improve connectivity to employment and residential areas.</p> <p>Consider future climate conditions when planning active transportation infrastructure, such as the need for additional trees for air quality improvement and heat mitigation or implementation of bioswales for floodwater retention.</p>	Near, Ongoing		
	<p>Explore opportunities and programs to increase access to healthy food markets, farmer's markets and other local food networks, particularly for low income residents and families.</p> <p>Work to expand access to healthy food, organic options and ensure affordability.</p> <p>Coordinate and partner with the County of San Diego's Live Well Community Market Program.</p>	Near to Mid	 	
	<p>Increase access to parks and open space for all San Diegans. Increase overall shaded area at park spaces. Natural shade from trees shall be prioritized over artificial shade structures whenever feasible.</p> <p>Access to parks and open spaces can provide cooling effect for localized areas during extreme heat events and can help improve air quality. Access to green spaces also improves quality of life, physical and mental health and promotes social cohesion.</p>	Near, Ongoing		
	<p>Incentivize installation of cool roofs and green roofs.</p> <p>a) Assess cool roof requirements under San Diego Municipal Code Charter 14, Article 5, Division 15. Consider broadening conditions that would require cool roof implementation.</p> <p>b) Assess feasibility of expansion of Eco-roof program from Centre City district to other areas of the City, with strong consideration for Transit Priority Areas, Communities of Concern and areas of high heat risk.</p>	Near, Ongoing		
	<p>Utilize the Urban Heat Vulnerability Index to inform implementation of adaptation strategies to address extreme heat events and identify priority areas for cooling interventions.</p> <p>The Urban Heat Vulnerability Index (UHVI) evaluates risk to extreme heat based upon social and health factors as well as exposure based upon land use. Utilize the UHVI to guide implementation of cooling strategies. Prioritize strategies with cooling and air quality benefits.</p>	Near		

Goal: Plan for and build a resilient and equitable City.

Policy RE-3: Prioritize strategies with multiple benefits that increase the adaptive capacity of the City's most vulnerable communities.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Establish a community garden program to convert vacant lots, rooftops or other available space to public community gardens.</p> <p>A public community garden program would support conversion of private or City owned vacant lots to community spaces.</p> <p>Program could include training sessions or courses to provide citizens with skills to empower community leadership for urban green spaces and could include toolkit to guide establishing garden and setting up volunteer network.</p>	Near		
	<p>Develop an urban greening program to promote expanded green spaces in urban areas. The program should facilitate greening of City buildings and encourage private development to include green features through policy development or incentive programs.</p> <p>The urban greening program should consider the following:</p> <ul style="list-style-type: none"> a) green walls. b) green facades. c) green roofs. d) "moss stops," and other projects that would add green spaces, either vertically or horizontally. <p>The program should include a guidance document that compiles best available research on green walls, facades, roofs or other urban greening tools to provide urban cooling and air quality improvement. The guidance document should provide technical advice on the design, construction and maintenance of these projects, and whether it may be feasible for them to serve as potential habitat.</p>	Mid		
	<p>Collaborate with the Air Pollution Control District (APCD) to implement the Community Emissions Reduction Plan (CERP) and AB 617.</p> <p>The Community Emissions Reduction Plan (CERP) works to reduce air pollution and improve public health for communities that disproportionately experience exposure to air pollution. The CERP works to reduce air pollution emissions and to lessen community exposure.</p>	Near to Mid		

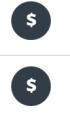
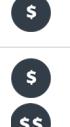
Goal: Plan for and build a resilient and equitable City.

Policy RE-4: Deepen community partnerships to support greater community involvement in resilience action and plan implementation.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Cultivate leadership and environmental stewardship in San Diego's youth. Consider partnerships with local schools and universities, and tribal organizations with active climate and resiliency programs, as well as focused internship programs and leadership opportunities.</p> <p>Build climate and eco-literacy through education and outreach materials.</p>	Near, Ongoing	 	 
	<p>Create principles for meaningful, equitable community engagement. Identify ways to remove barriers to participation.</p> <p>In coordination with the Office of Race and Equity, develop principles for community engagement that meaningfully involve frontline communities and Communities of Concern to guide outreach and engagement efforts during Climate Resilient SD plan implementation.</p>	Near	 	 
	<p>Promote water conservation, water reuse and best management practices in local businesses and industry.</p> <p>Example programs include: Guaranteed Water For Industry: participating businesses use reclaimed water to extent possible in manufacturing, cooling, landscaping or other operations. Participating businesses also implement best management practices for potable water conservation in their facilities and operation. Participation in program provides businesses assurance of available supply of water and discounted rates for reclaimed water usage.</p>	Near, Ongoing	   	 

Goal: Plan for and build a resilient and equitable City.

Policy RE-5: Ensure vulnerable communities have resources necessary to respond to climate change impacts.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Support community-centered resilience action. Partner with community-based organizations to promote preparedness and response actions.</p> <p>Develop centralized virtual location for information and resources related to climate change hazard events and response. Work with community-based organizations to identify and meet community specific needs.</p>	Near, Ongoing		
	<p>Develop resilience hubs in coordination with County of San Diego Public Health Department and community-based organizations. Resiliency hubs can provide shelter, food distribution, healthcare, or other services as needed. Evaluate feasibility of solar microgrid battery backup implementation.</p> <p>Resilience hubs can enhance climate resilience by serving as cooling centers, emergency shelters or providing training on coping with climate change hazards. Coordinate with the County, community partners and Office of Emergency Services.</p>	Mid		
	<p>Coordinate with the County of San Diego Department of Public Health on Cool Zones program. Provide easily accessible locations, particularly in Communities of Concern. Expand access to Cool Zones, shade corridors, and the coast.</p> <p>Ensure City residents are informed about cooling center locations available during extreme heat events. Designate and add additional cooling centers as needed that are accessible, near vulnerable populations, and/or co-located with other services. Explore development of a Cool Zones App that would help people get information about extreme heat events, locate designated Cool Zones, and identify shade corridors.</p>	Near, Ongoing		
	<p>Explore opportunities for neighborhood microgrants to funds community-driven projects to enhance community resilience and foster community connections.</p> <p>Grants could go toward community garden, community greening, or other community enhancing projects. Microgrant program would be designed to foster connection, develop local leaders, engage citizens, create a greater sense of community and provide resilience benefits.</p>	Mid		

Goal: Safeguard, preserve and protect historic and tribal cultural resources from the effects of climate change.

Policy HTC-1: Preserve and protect historic and tribal cultural resources against climate change impacts.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Practice proactive and robust decision-making for cultural resources. Use modeling and scenario planning to understand likely future impacts of climate change on individual resources; identify intervention options available to mitigate impacts; and implement the intervention measures in a timely manner to maximize preservation efforts.</p>	Mid		

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Consider historic properties of religious and cultural significance to local tribes during consultation to develop appropriate avoidance measures and/or project redesign opportunities to protect resources.</p>	Near, Ongoing		

Goal: Safeguard, preserve and protect historic and tribal cultural resources from the effects of climate change.

Policy HTC-2: Foster partnerships and collaboration opportunities with tribal liaisons and partners.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Coordinate resilience planning with tribal groups and representatives through government-to-government consultation. Foster greater collaboration with representatives of local tribal nations and/or intertribal organizations with traditional knowledge of native species diversity and ecological processes and patterns that honors historical knowledge of tribal natural resource management adaptive management and resource protection.</p>	Near, Ongoing		

Goal: Safeguard, preserve and protect historic and tribal cultural resources from the effects of climate change.

Policy HTC-3: Honor and share traditional knowledge of land management and cultural significance.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Research, write and share climate stories, particularly related to historic and tribal cultural resources.</p> <p>Document history and heritage of historic and tribal cultural resources. Consider methods for storytelling, such as StoryMaps, interpretive signage or education kiosks, and consider incorporation of Native American interpretive signage and public art opportunities in collaboration with local tribal groups and intertribal organizations as part of future planning and project design. Collaborate with subject matter experts, tribal representatives and local universities for creation and sharing of stories.</p>	Mid		

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Incorporate Indigenous Knowledge/Traditional Ecological Knowledge (IK/TEK) into the preservation and protection of historic and tribal cultural resources.</p> <p>Develop stewardship opportunities in collaboration with local tribal groups and intertribal organizations that incorporate traditional tribal knowledge for the protection, management, and monitoring of tribal cultural resources for ongoing resiliency planning efforts.</p>	Mid		 

Goal: Safeguard, preserve and protect historic and tribal cultural resources from the effects of climate change.

Policy HTC-4: Incorporate climate change consideration into historic and tribal cultural planning and stewardship.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Develop and implement a cultural resources management plan that aims to reduce stress and minimize exposure of historic, archaeological, and tribal cultural resources to climate change impacts.</p> <p>a) Develop a prioritized list of historic and cultural resources to preserve and protect from climate change impacts for current and future generations. Collaborate with subject matter experts, archeological community, tribal representatives and local universities to develop methods for prioritization. Prioritization factors may include: significance of the resource, rarity of the resource, immediacy of the climate change threat, stakeholder input and the feasibility, effectiveness and cost of available interventions.</p> <p>b) Develop a cultural resources management plan that includes a baseline of existing resources condition, identifies necessary active interventions and include a monitoring program to track conditions of cultural resources and identify vital signs for resource impact.</p> <p>c) Evaluate staffing and budgetary needs for ongoing resiliency planning and monitoring of historic and tribal cultural resources. Coordinate across City departments.</p>	Mid		 

Goal: Support and prioritize thriving natural environments and enhance adaptability.

Policy TNE-1: Protect environmental quality and biodiversity.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	Develop an ecosystem fire recovery master plan to address revegetation and post-fire treatments for open space and community parks if affected by wildfire. The ecosystem fire recovery master plan will outline implementation actions for post-fire treatments to protect and improve ecosystem health.	Near to Mid		\$ N/A
 	Develop an action plan to support the completion of the City's Multiple Species Conservation Plan Preserve. The action plan should include, but is not limited to, the following: a) Support acquisition of target habitat types within the Multi-Habitat Planning Area (MHPA) to meet overall conservation goals under the MSCP Implementing Agreement. Strong consideration for habitat types with greater conservation gaps should be given, including but not limited to: freshwater marsh, open water, disturbed wetland and shallow bays. b) Update Habittrak to depict MHPA boundary line adjustments to accurately account for City conservation acreage inside the MHPA. c) Assemble interdepartmental City MHPA acquisitions team to guide and streamline MHPA land acquisition process. d) Create and foster MSCP partnerships.	Near to Mid		\$ \$
 	Continue to implement land management practices that support ecosystem function and healthy watersheds and, in turn, increase the capacity of the system to withstand stress due to climate change. Land management practices include: brush/vegetation management around City raw water storage reservoirs, invasive species or weed removal in watershed, habitat restoration, streambed rehabilitation for riparian protection, implementation of stormwater best management practices and erosion control measures.	Near, Ongoing		\$ \$
 	Protect, restore and enhance urban canyons. Support habitat restoration of urban canyons with native plant species, inclusion of environmental education and recreation opportunities and continued preservation. Urban canyons provide ecosystem services including biodiversity, water quality improvement, heat mitigation and provision of habitat. They also provide recreational opportunities and opportunity to connect and learn about nature.	Near, Ongoing		\$\$ \$\$

Goal: Support and prioritize thriving natural environments and enhance adaptability.

Policy TNE-2: Protect and improve the integrity of open space, habitat and parks.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Prioritize the preservation, restoration and expansion of natural features such as habitat, open space, wetlands, kelp forests, marshes and vegetated buffers to increase resilience of natural systems. Continue to implement and uphold the Multiple Species Conservation Program to preserve network of habitat and open space and to protect biodiversity.</p> <p>Expand open space and protect natural ecosystems in flood hazard areas.</p> <p>Protect integrity of existing wetlands. Consider restoration program to restore degraded habitat and expansion of wetland habitat as feasible.</p>	Near, Ongoing		
	<p>As identified in the Parks Master Plan, complete a Trails Master Plan. Trails Master Plan should account for climate change impacts, such as increased erosion due to precipitation or sea level rise.</p> <p>The proposed Trails Master Plan would confirm trail construction standards for new trail construction, identify which trails should remain, identify trails to be restored to natural condition and identify trails that require upgrade projects.</p> <p>Trail maintenance procedures for cliff trails, parks and preserves should consider increases in erosion and flooding due to climate change hazards.</p>	Near, Ongoing		
	<p>Conduct regular brush management in high wildfire risk zones.</p> <p>Vegetation and brush management reduces intensity and spread of wildfire. As needed, brush management should include: invasive species removal, vegetation or brush removal, tree maintenance and removal projects, controlled burn programs, creation of defensible space, fuel breaks and open space management.</p>	Near, Ongoing		
	<p>Complete inventory of open space and community park plans to identify needs as related to climate change impacts.</p> <p>Inventory will include:</p> <ul style="list-style-type: none"> a) Status of open space and community park planning efforts. b) Identification of updates required to inform habitat protection, species preservation and natural resource protection. 	Near		

Goal: Support and prioritize thriving natural environments and enhance adaptability.

Policy TNE-2: Protect and improve the integrity of open space, habitat and parks.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Update open space and community park plans as needed, including master plans, precise plans, general development plans, and natural resource management plans to protect open space and park land against impacts of climate change and to improve natural integrity.</p> <p>Considerations include:</p> <ul style="list-style-type: none"> a) Shifts in habitat for endangered or protected species. Consideration of habitat expansion or corridor connections to provide adequate range for movement, migration and interaction of species. b) Preservation and restoration of natural features, such as habitat, open space, wetlands, marshes, vegetated buffers and coastal dunes. c) Increased native plantings to improve natural resiliency to climate conditions, such as drought and wildfire, as well as for natural cliff stabilization. d) Protection of recorded cultural resources. 	Near, Ongoing		N/A

Goal: Support and prioritize thriving natural environments and enhance adaptability.

Policy TNE-3: Prioritize the implementation of nature-based climate change solutions wherever feasible.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Implement nature-based shoreline protection methods to protect areas subject to coastal flooding. Develop a coastal resilience master plan that would identify locations for implementation of nature-based solutions to mitigate coastal flooding and erosion, improve coastal resiliency, protect habitat, and increase recreational opportunities for residents and visitors.</p> <p>Nature-based shoreline protection could include beach nourishment, living shorelines, dune restoration, native plantings, habitat restoration, waterfront/floodable parks, kelp farms or oyster reefs.</p>	Near, Ongoing		

Goal: Support and prioritize thriving natural environments and enhance adaptability.

Policy TNE-4: Prioritize the implementation of green infrastructure wherever feasible.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
 	<p>Improve stormwater infrastructure resilience.</p> <p>Enhance implementation of the Watershed Asset Management Plan (WAMP) to evaluate stormwater infrastructure vulnerability to flooding and prioritize infrastructure upgrade and replacement based on highest risk. This includes stormwater pump stations, outfalls, pipes, culverts, levees and channels. Actions include:</p> <ul style="list-style-type: none"> a) Complete condition assessments for assets. b) Develop upgrade and replacement implementation schedule. c) Evaluate/develop resilience design standards. d) Incorporate a holistic approach for flood mitigation planning and modeling by performing watershed master planning. 	Near to Mid		
 	<p>Maximize planning and implementation of green infrastructure at watershed scale and site specific.</p> <p>Green infrastructure (GI) provides many benefits to our communities and natural environments. The City invests in GI as an effective, multi-benefit and integrated strategy to protect communities from flooding and protect our waterways from pollutants. GI implementation may include:</p> <ul style="list-style-type: none"> a) Pursue supplemental funding sources to cover capital cost of GI. b) Expand public outreach to increase awareness of GI benefits. c) Partner with non-profit groups on GI implementation. d) Develop GI design standards to improve GI effectiveness. e) Evaluate and advocate for legislation to support GI. 	Near to Mid		

Goal: Support and prioritize thriving natural environments and enhance adaptability.

Policy TNE-5: Manage the coastline as a social, economic and environmental resource for current and future generations.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Update the City's Local Coastal Program.</p> <p>Local Coastal Program update should incorporate consideration for sea level rise, including coastal flooding and erosion, consistent with State guidance documents and with draft policies included in the Draft Local Coastal Program Policies (Appendix D).</p>	Mid		
	<p>For city-owned properties and leaseholds, consider rolling easements to establish a development boundary that moves inward as sea level rises along the shoreline.</p> <p>Establish the easements as needed to allow for natural migration of shoreline and avoid shoreline armoring.</p>	Long		
	<p>Update the Coastal Erosion Assessment regularly to identify current conditions of coastline bluffs, beaches, access stairs, ramps, outfalls, seawalls or other related infrastructure.</p> <p>The Coastal Erosion Assessment should be updated every five years to evaluate the status of coastline erosion or shoreline change. The assessment will help identify priority locations for projects and funding. Based on findings from Coastal Erosion Assessment, identify funding needs for priority projects to protect public health and safety, protect integrity of coastal habitats and protect coastal access.</p>	Near, Ongoing		
	<p>Utilize adaptive pathways for coastline planning.</p> <p>Adaptive pathways are a sequence of adaptation strategies over time that consider uncertainty and future risk. An adaptive pathways approach should include completion of an economic analysis to evaluate efficiency and effectiveness of adaptation strategies over time. Adaptive pathways should consider:</p> <ul style="list-style-type: none"> a) Prioritization of nature-based solutions and natural shoreline protection methods to protect areas subject to coastal flooding. b) Consideration of resilience or relocation options for areas highly vulnerable to coastal erosion and/or coastal flooding. c) Consideration of less intensive uses for City assets, such as transition from vehicle based facilities to bike based facilities. 	Mid		

Goal: Support and prioritize thriving natural environments and enhance adaptability.

Policy TNE-6: Protect and expand the City's urban forest.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
 	<p>Maintain and expand the City's urban tree canopy to meet the City's Climate Action Plan goals.</p> <p>Explore innovative funding opportunities to support the expansion and maintenance of the urban tree canopy. Explore options to support tree planting, such as a streamlined process for street trees, or an expanded free tree program.</p>	Near, Ongoing	      	 
   	<p>Incorporate considerations for a changing climate into urban forestry management and planning. Update the Urban Forestry Program 5 Year Plan with consideration for tree species diversification, salt tolerance and irrigation needs.</p> <p>The Urban Forestry Program 5 Year Plan should consider:</p> <ul style="list-style-type: none"> a) Diversification of tree species, including diversifying tree species that are adapted to higher temperatures and diversifying tree species for those that require less water, such as native species. b) Planting trees tolerant of future climate conditions, such as salt tolerant trees near the coast. c) Consider future irrigation needs for trees. d) Updated guidance for Street Trees Program. 	Near	      	 N/A

Goal: Maintain and ensure minimal disruption to all critical City services in the face of climate change hazards.
Policy CCS-1: Protect public health and safety.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Identify critical transportation network elements and create emergency transportation alternatives and detours for vulnerable routes. Prioritize corridors that act as evacuation routes or provide access to critical facilities.</p> <p>Develop emergency evacuation plans that account for the increasing geographic risk of extreme weather events and that specifically address the needs of vulnerable populations. Evacuation plans should include all modes of transportation and address the needs of people with disabilities and people experiencing homelessness. Evacuation plans should also include route planning, notification testing, potential need for emergency sheltering, and access, egress and road maintenance.</p>	Near to Mid		
	<p>Develop flood assistance program.</p> <p>Program could include technical advice or materials, such as sandbags and plastic sheeting. Provide flood protection information and resources to community residents and businesses in advance of an event and ensure that vulnerable populations have access to these resources at low or no cost.</p>	Mid		
	<p>Establish levees inspection and maintenance program to ensure the levee system continues to provide an adequate flood protection. Update the Levee System Operation and Maintenance Manual.</p> <p>Establish levees inspection and maintenance program to ensure the levee system continues to provide an adequate flood protection.</p> <ul style="list-style-type: none"> a) Conduct inspections and address maintenance deficiencies. b) Update the Levee system Operation and Maintenance Manual. c) Enforce floodplain regulations to protect structures from flooding. 	Mid		

Goal: Maintain and ensure minimal disruption to all critical City services in the face of climate change hazards.
Policy CCS-2: Secure and maintain water and wastewater supplies and services.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Continue to update the Urban Water Management Plan every five years to reexamine future vulnerabilities to the City water supply.</p> <p>The Urban Water Management Plan (UWMP) describes the water service area, water demands and supplies, water conservation activities and assesses the reliability of water sources over a 20-year planning time frame. The City's UWMP plan is for 2020-2025, with a planning horizon of 2045. It includes a new water reliability analysis that shows the value of efforts to diversify the City's water supply sources under scenarios considering drought, climate change and seismic events.</p>	Near, Ongoing	 	
	<p>Continue efforts to diversify the City's water supply sources and reduce dependence on imported water.</p> <p>Further reduce City reliance on other water sources and increase resiliency of City's water sources. Pure Water Phase I will treat recycled water to produce 30 million gallons of purified water per day. Phase II will further reduce City dependence on imported water sources.</p>	Near, Ongoing	 	
	<p>Promote stormwater as a resource concept by implementing capture and reuse technologies where feasible.</p> <p>Increase opportunities for stormwater capture and reuse by evaluating different harvesting methodologies to determine viable options.</p> <p>a) Complete a stormwater harvesting assessment study. b) Develop implementation strategies for viable stormwater capture and reuse options.</p>	Near to Mid	 	
 	Replace or rehabilitate water and wastewater pipes to maintain a state of good repair, minimize breaks and ensure structural integrity in the face of climate change hazards such as flooding.	Long	 	
 	As Water Design Guidelines and Sewer Design Guidelines are updated, consider climate change impacts, such as sea level rise, coastal erosion and changes in precipitation.	Mid	 	
 	<p>Account for projected changes in precipitation and sea level rise in water and wastewater planning.</p> <p>The following plans should be considered for update: PUD Water Facilities Master Plan, Integrated Master Plan, and the Forecast Informed Reservoir Operations.</p> <p>Monitor the effects of sea level rise on groundwater resources and identify actions to reduce the possibility of toxic contamination resulting from sea level rise.</p>	Near to Mid	 	

Goal: Maintain and ensure minimal disruption to all critical City services in the face of climate change hazards.
Policy CCS-2: Secure and maintain water and wastewater supplies and services.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Prepare and implement a facility climate change action plan for Point Loma Wastewater Treatment Plant.</p> <p>Point Loma Wastewater Treatment Plant Climate Change Action Plan should include the following:</p> <ul style="list-style-type: none"> a) Identifies impacts based on best available science for climate change projections. b) Identifies steps taken or planned action to address greenhouse gas emissions. c) Identifies steps taken or planned actions to address climate change related impacts related to sea level rise, changes in precipitation, climate related changes to wastewater flows and climate related changes to influent characteristics. <p>Additional actions could include a site specific study to address potential sea level rise, storm surge and coastal erosion effects at Metro System collection and treatment facilities.</p>	Near		\$ \$
	<p>Continue efforts to increase wastewater diversion to further reduce likelihood of sanitary sewer overflow.</p> <p>Climate change may result in increased sewer system infiltration and inflow due to increased precipitation intensity and coastal flooding. Additional wastewater diversion increases adaptative capacity of system given uncertainty in the degree to which climate change will influence future infiltration and inflow.</p>	Near to Mid		\$\$\$ \$
	<p>Conduct detailed site assessments at active, identified vulnerable waste and wastewater facilities and identify climate change hazard risk mitigation options.</p> <p>Site specific evaluations will refine the findings of the citywide Climate Change Vulnerability Assessment to account for site specific and facility specific factors. Site assessments will consider the asset's physical characteristics; interdependencies; exposure, sensitivity and adaptive capacity to relevant hazards; overall vulnerability; potential adaptation strategies; and feasibility of implementation options.</p>	Mid to Long		\$ \$
	<p>Integrate projected increases in wildfire frequency and intensity into watershed management and planning, dam and raw water reservoir operations and dam emergency planning, in alignment with the City's Climate Action Plan.</p>	Mid		\$ \$
	<p>Promote water conservation through updates to City irrigation system.</p> <p>Updates to irrigation systems can conserve water and save energy. Water management increases irrigation precision to avoid runoff or excess saturation of soil.</p>	Mid		\$\$ \$

Goal: Maintain and ensure minimal disruption to all critical City services in the face of climate change hazards.
Policy CCS-3: Improve ability of infrastructure and built systems to withstand climate change shocks and stressors, while maintaining provision of essential services.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Provide cooling systems for City assets and equipment sensitive to overheating.</p> <p>Complete a review of current equipment and specifications, such as electronics, vehicles and generators, to determine their ability to operate in high heat conditions. Secure cooling systems as necessary to maintain City operations.</p>	Mid		
	<p>Plan for a climate ready transportation network.</p> <p>Consider alternative surfaces and cool pavement surfaces when resurfacing roads, critical intersections, multi-use paths and city parking lots. Use alternative pavement surfaces, such as concrete, at critical locations like intersections or bus stops to reduce rutting and cracking due to excess pressure on hot days. Consider other materials that can prevent or reduce buckling of roadways or bridges due to high temperatures. Use light-colored asphalt pavement and consider high-reflectivity hardscape to reduce heat absorption and reflect radiation.</p> <p>Protect road shoulders, embankments and pedestrian and bicycle facilities against erosion. Utilize erosion control treatments including grading, seeding or revegetation, mulch, engineered riprap, hybrid dune and cobble.</p>	Near, Ongoing		
	<p>Consider raising of roadways to manage current and future extreme weather events, where needed to ensure public safety.</p>			
	<p>Identify and implement flood protection measures for critical infrastructure.</p> <p>Flood protection measures could include: elevating assets above a defined flood level, waterproofing equipment, installing back-up power, placement of sandbags installing flood wall or removable flood barriers, deployable assets and/or waterproofing buildings.</p>	Mid		
	<p>Protect mechanical, electrical and other key operational equipment from flooding at critical facilities through facility improvements or adaptive action.</p> <p>Protection of key operational equipment could include elevation of sensitive equipment above anticipate flood levels, design of structures to withstand exposure to flood water or retrofits to protect against flood conditions.</p>	Near, Ongoing		
	<p>Conduct site assessments at City facilities and ensure effective management of vegetation, defensible space and hardening of assets as feasible for wildfire preparedness.</p> <p>Conduct site assessments for critical City facilities within very high fire hazard zone. Site assessments examine vulnerability of site and develops specific adaptation actions to reduce wildfire risk.</p>	Mid		

Goal: Maintain and ensure minimal disruption to all critical City services in the face of climate change hazards.
Policy CCS-4: Build City capacity to be responsive to future climate change related events and challenges.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Develop workforce preparedness training opportunities and programs to quickly restore essential City services.</p> <p>Review department-level emergency response and management plans, such as Continuity of Operations Plans, to determine if emergency response and recovery strategies account for climate hazards. Incorporate climate hazards into emergency management plans, if necessary, and provide disaster preparedness training to City employees.</p>	Near, Ongoing		\$ \$
	<p>Build redundancy and/or backup resources available to support critical operations and services during an emergency event.</p> <p>a) Maintain list of critical facilities and critical load required for emergency operations.</p> <p>b) Provide critical facilities with diverse sources of energy in case primary source of power is disrupted.</p> <p>c) Support shift toward renewable energy sources of backup power.</p> <p>d) Develop redundant, back-up communication systems between departments to reduce reliance on cell phones in emergencies.</p> <p>e) Secure backup resources, such as backup vehicles, fuel supply, debris removal equipment, rescue equipment, and temporary flood barriers as necessary.</p>	Near, Ongoing		\$\$ \$
	<p>Implement a knowledge transfer and training program to ensure that natural hazard response procedures are not lost with staff turnover.</p> <p>Document existing and future natural hazard response protocols. Hold annual trainings in response departments.</p>	Near, Ongoing		\$ \$
	<p>Create web map for primary climate change hazard. Update City's geographic information system database as best available science for climate change projections and State guidance is updated.</p> <p>Layers to be included and updated regularly, include but are not limited to:</p> <p>a) Federal Emergency Management Agency floodplain layers.</p> <p>b) New Ocean Protection Council or California Coastal Commission guidance on sea level rise or new Coastal Storm Modeling System (CoSMoS).</p> <p>c) New California Environmental Protection Agency Urban Heat Island Index.</p> <p>d) Fire Hazard Severity maps.</p>	Near, Ongoing		\$ \$

Goal: Maintain and ensure minimal disruption to all critical City services in the face of climate change hazards.
Policy CCS-4: Build City capacity to be responsive to future climate change related events and challenges.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Account for high heat days when planning City staff duties to minimize exposure to extreme heat and/or provide necessary protective measures.</p> <p>Comply with the Illness and Injury Prevention Plan. Ensure that staff have adequate cooling breaks, sun protection and hydration. Provide heat protective measures for City staff who may be exposed to extreme heat during workdays.</p>	Near, Ongoing		\$ \$
	<p>Consider the value of combining renewable generation with battery energy storage systems and/or microgrid installations to increase resiliency in the face of climate change driven energy disruptions, reduce energy costs and support a stable electric grid.</p> <p>Assess implementation of microgrids and battery storage systems to provide backup power for critical city operations and communities. Power microgrids and battery storage with renewable energy sources. Utilize on site energy sources as feasible. Consider implementation of Grid Interactive Efficient Buildings to support implementation and connection of microgrids, provide greater flexibility in energy use and demand response and improve energy efficiency.</p>	Near to Mid		\$\$ \$\$
	<p>Implement resilient redesign or identify less intensive land uses for City-owned property exposed to flooding.</p> <p>Resilient redesign could include conversion of leaseholds into riparian buffers or flood mitigation areas to restore natural areas and mitigate flooding. As leases expire, determine most beneficial use of land based on climate change projections.</p>	Long		\$\$ \$
	<p>Establish a Chief Resilience Officer.</p> <p>The Chief Resilience Officer would lead implementation of Climate Resilient SD. Role responsibilities may include coordination of adaptation strategy implementation, tracking progress across City departments, participating in regional efforts for adaptation planning and implementation and continuing community and stakeholder engagement related to plan implementation.</p>	Near to Mid		\$ \$
	<p>Identify City buildings appropriate for installation of distributed energy resources like battery energy storage and microgrids to increase City capacity to respond to climate change driven energy disruption and reduce energy costs.</p> <p>Consider size of microgrid required to support critical load during emergency. Improve energy efficiency of City buildings to reduce overall energy demand and required battery storage capacity. Develop emergency operations energy profiles for critical operations facilities that consider energy needs during times of emergency response.</p>	Near to Mid		\$ \$\$ \$ \$\$
	<p>Explore siting renewable generation projects on City-owned land, landfills, lakes and reservoirs.</p>	Mid		\$ \$\$ \$

Goal: Maintain and ensure minimal disruption to all critical City services in the face of climate change hazards.

Policy CCS-5: Consider cost, effectiveness, lifespan, and core benefits for adaptation strategy prioritization and implementation.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Create a City tracking system to monitor the cost of climate change hazard impacts and response.</p> <p>Internal system to track City expenditures related to climate change impacts and response. System would capture smaller events that are not currently tracked by Initial Damage Estimate reports. The tracking system would facilitate reporting on actions taken as well as inform future action when larger capital projects may be required.</p>	Mid	 	
	<p>Develop post-hazard tracking system to collect post-event cost data for events that are both above and below the national hazard declaration threshold. Track in a shared asset management database for climate change hazard related cost impacts.</p> <p>a) Establish a digital reporting system for City employees to record and track disaster response and recovery.</p> <p>b) Recommended metrics for tracking impacts and costs of extreme weather and climate change: frequency of extreme weather events; extent and cause of weather-related damage or infrastructure closures; resultant community impact; maintenance and repair costs; costs of materials/staff time; and frequency of emergency fund requisition.</p>	Near, Ongoing	 	
	<p>Develop guidance for capital planning, including resilient design standards for City infrastructure upgrades that considers climate change projections.</p> <p>Consider the project's function, lifespan, location, asset type and core benefits provided by the project. Includes resilient design criteria as prioritization factor for capital improvement projects.</p>	Near	 	

Goal: Maintain and ensure minimal disruption to all critical City services in the face of climate change hazards.

Policy CCS-6: Prepare City for upcoming funding opportunities from State, Federal and grant programs to ensure City is competitive to secure funding.

CLIMATE HAZARDS	ADAPTATION STRATEGY AND ADDITIONAL INFORMATION	TIMEFRAME	CORE BENEFITS	COST CAPITAL / O&M
	<p>Explore proven financing tools and emerging grant opportunities to fund resilience focused projects.</p> <p>Create a climate resilience specific fund for capital improvement projects. Consider green bonds or resilience focused bonds. Explore policies and funding mechanisms to maintain existing trees and plant and maintain new trees. Coordinate resiliency planning to best position the City to be competitive for State and Federal grant opportunities. Explore other financing tools, such as energy savings performance contracts.</p>	Near, Ongoing		\$ \$
	<p>Integrate climate adaptation, resilience and hazard mitigation into long range planning documents as well as land use planning, capital and budget plans.</p> <p>Long range planning documents could include, but are not limited to: General Plan, Community Plans, Mobility Action Plan, Climate Action Plan, Integrated Regional Water Management Plan, Watershed Master Plans and Chief Financial Officer 5-year forecast.</p>	Near to Mid		\$ \$
	<p>Form a City department climate adaptation working group to coordinate on climate adaptation implementation efforts.</p> <p>Effective implementation will require strong coordination between City departments. Establish a climate adaptation point person for each department to lead that Department's implementation actions and supporting actions for applicable adaptation strategies.</p>	Near, Ongoing		\$ \$

This page intentionally left blank.



Appendix B

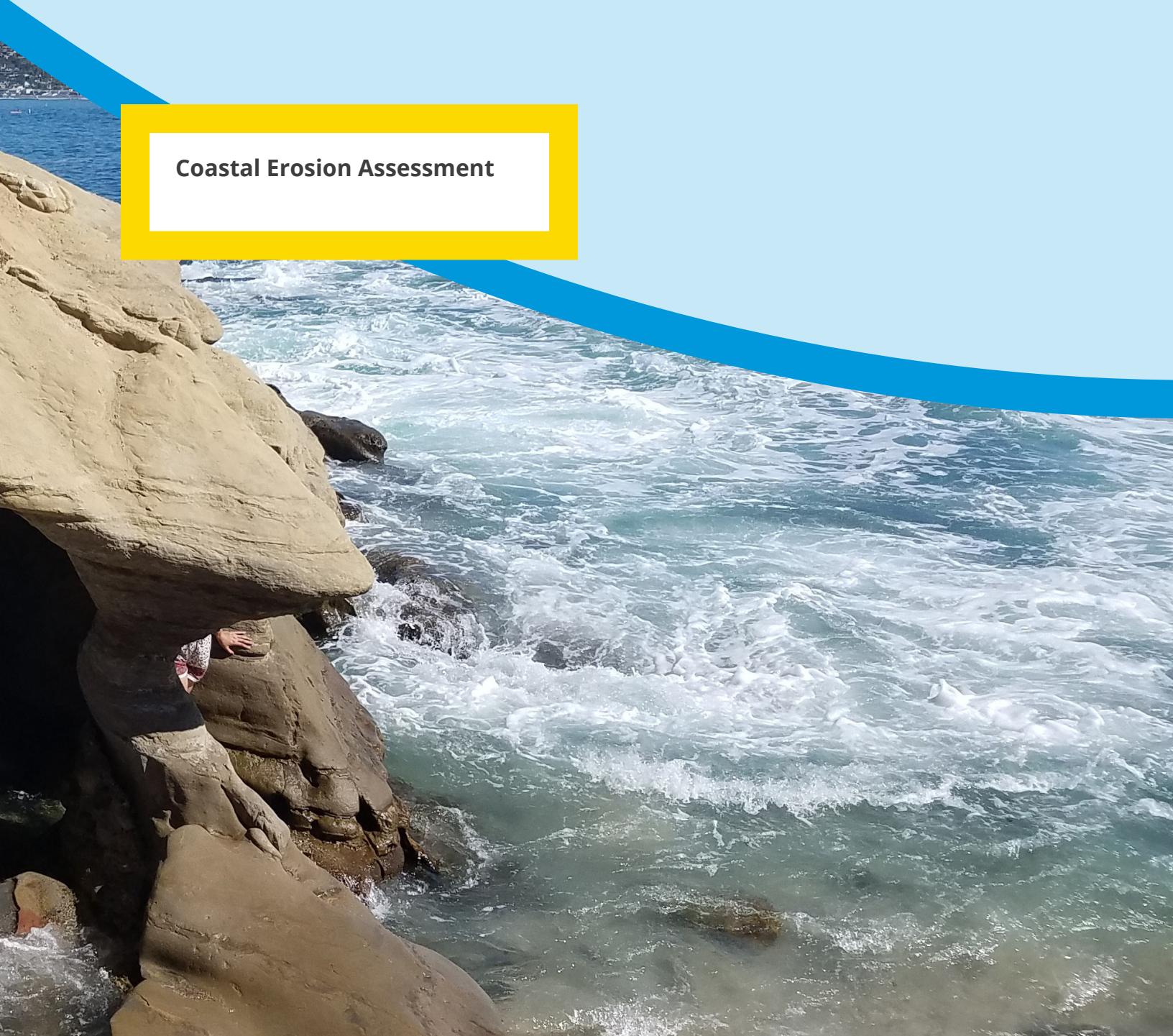
Climate Change Hazard
Vulnerability Assessment





Appendix C

Coastal Erosion Assessment





Appendix D

Draft Local Coastal Program
Policies

